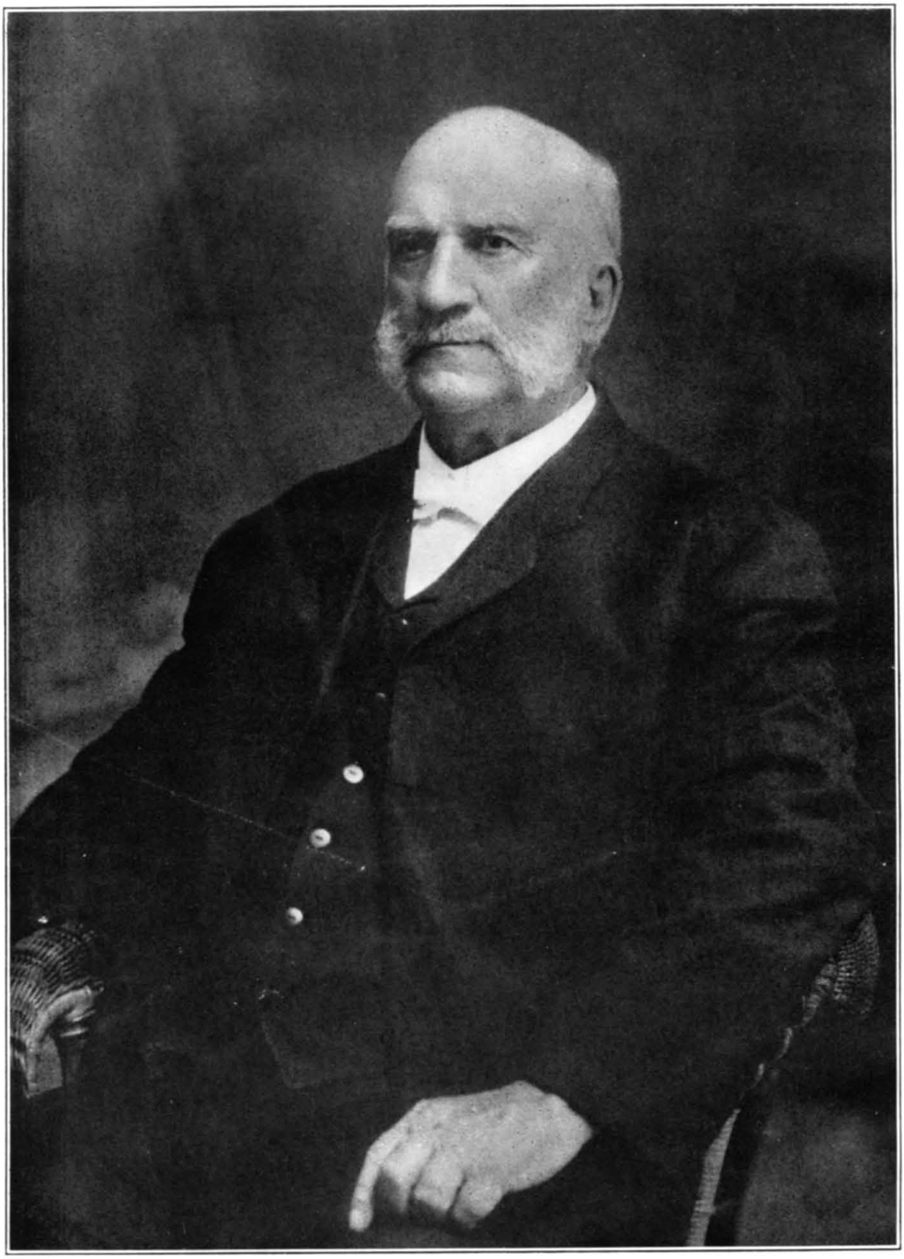

SEAMAN ASAHEL KNAPP.

YEARBOOK

OF THE

UNITED STATES DEPARTMENT OF AGRICULTURE.

1911.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1912.

[CHAPTER 23, Stat. at L., 1895.]

[AN ACT Providing for the public printing and binding and the distribution of public documents.]

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Section 73, paragraph 2:

The Annual Report of the Secretary of Agriculture shall hereafter be submitted and printed in two parts, as follows: Part One, which shall contain purely business and executive matter which it is necessary for the Secretary to submit to the President and Congress; Part Two, which shall contain such reports from the different Bureaus and Divisions, and such papers prepared by their special agents, accompanied by suitable illustrations, as shall, in the opinion of the Secretary, be specially suited to interest and instruct the farmers of the country, and to include a general report of the operations of the Department for their information. There shall be printed of Part One, one thousand copies for the Senate, two thousand copies for the House, and three thousand copies for the Department of Agriculture; and of Part Two, one hundred and ten thousand copies for the use of the Senate, three hundred and sixty thousand copies for the use of the House of Representatives, and thirty thousand copies for the use of the Department of Agriculture, the illustrations for the same to be executed under the supervision of the Public Printer, in accordance with directions of the Joint Committee on Printing, said illustrations to be subject to the approval of the Secretary of Agriculture; and the title of each of the said parts shall be such as to show that such part is complete in itself.

PREFACE.

Aside from the Report of the Secretary, the Yearbook of the Department of Agriculture for 1911 comprises (1) 31 articles, contributed by the various branches of the Department and averaging 13 pages; (2) a statistical Appendix of 194 pages; and (3) an Index of 32 pages—the volume aggregating 730 pages. The articles are illustrated by 20 text figures and 67 full-page illustrations, of which 9 are colored. Although 10 pages in excess of the Yearbook for 1910, this volume is in reality smaller and weighs less, because in most instances the full-page illustrations are printed on both sides of the sheet. This feature is an innovation introduced with a view to economy, and it is believed that the illustrations are as satisfactory as when printed in the old way.

The articles included in the Yearbook have not been published elsewhere. This explanation is given for the reason that there is an impression that the volume is a compilation of bulletins and circulars issued during the year. Such, however, has never been the case, as it has always been the policy of the Secretary to use as Yearbook articles only absolutely new matter having a permanent value, giving preference to accounts of work undertaken and results achieved. The articles are usually reprinted in separate form after the Yearbook is issued. This gives them a wider distribution and enables the Department to give applicants the specific information they desire, when it is impossible to supply the entire volume. As a matter of fact, the department's allotment of the Yearbook is distributed principally to its voluntary correspondents, in consequence of which it is necessary to refer miscellaneous applicants to Members of Congress, to whom 470,000 copies are by law allotted. The edition of the Yearbook authorized by law is 500,000, so that in the 18 years during which it has been issued 9,000,000 copies have been printed and distributed, principally to farmers in every section of the country.

The frontispiece to this volume is a portrait of the late Dr. S. A. Knapp, who died during the year, and whose distinguished services in behalf of the people justify this tribute to his memory. A brief article describing the work of Dr. Knapp is contributed by the Chief of the Bureau of Plant Industry.

The latest figures in regard to the production and value of the principal agricultural crops and the number and value of farm animals, together with tables of exports and imports, are given in the Appendix, which has been carefully compiled by the Bureau of Statistics with the view to being helpful to all in search of information on these subjects.

Of timely interest are the summary tables taken from the agricultural returns of the Thirteenth Census. These figures refer to number, area, and value of farms; value of farm buildings and live stock; farm expenses, classified under labor, feed, and fertilizer; mortgages; and nativity of farmers.

The figures relating to the production and farm value of the leading crops in 1911 are of special interest, because crops were relatively small and values relatively high. In 1911 the corn crop declined in quantity 355,000,000 bushels, compared with 1910, but the value increased $180,000,000, owing to higher farm prices. Oats, barley, and potatoes also were less in quantity but greater in farm value in 1911 than the year before. The wheat crop showed but slight change, although the quantity fell off 2 per cent and the value also was less in 1911 than in 1910 by about 1 per cent. The hay crop was nearly 14,000,000 tons short, compared with 1910, and in spite of prices being about one-fifth higher than the year before the total farm value of the crop declined more than $50,000,000.

Inquiry has sometimes been made why the list of publications issued during the year is not included in the Yearbook. To include such a list would involve duplication, since, in compliance with a specific provision of law, a report of the documents of all kinds issued and distributed by this department is made annually to Congress. Applicants, however, can always secure lists of available publications by writing to the department, and will be supplied with such publications as they may select, so long as copies are available for distribution.

In general, this volume agrees in form and style with its predecessors, and it is hoped that it may equal them in value and popularity.

JOS. A. ARNOLD,
Department Editor.

U. S. DEPARTMENT OF AGRICULTURE,
Washington, D. C., April 24, 1912.

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YEARBOOK

OF THE

U. S. DEPARTMENT OF AGRICULTURE.

REPORT OF THE SECRETARY.

Mr. President:

I respectfully present my Fifteenth Annual Report, covering the work of the Department of Agriculture for the year 1911.

BRIEF COMMENTS.

When the cattle-fever tick is destroyed in the Southern States the country will get much more meat from that section and the producing of it will build up the farms there.

The hog-cholera serum developed in this department is successful where it is properly made and applied.

Would it be asking too much of our universities to have them educate more plant pathologists and road engineers?

Every country in the world that has diseased plants that can not be sold at home can ship them to us. This results in great loss. The chestnut disease here is an illustration.

After years of experimentation we find we can grow Egyptian cotton in southern California and bulbs in the State of Washington.

The finest dates from the Sahara Desert succeed in our Southwest.

No seed is sent out from this department without being tested for germination condition.

The schools want more of our publications than we have to give them.

Seven hundred and fifty million dollars is the best estimate for poultry products this year.

The day is not far distant when we will cease to import potash.

A serious pest in the South is the crayfish; carbon bisulphid is a sure remedy.

We are sending explorers to the ends of the earth for new plants—and getting them.

The phosphates are abundant in our country for all possible uses. Florida, Kentucky, Tennessee, and Idaho may be mentioned as depositories.

If good roads from the producer to the consumer were general, the benefits to both would be considerable.

When a foreign insect invades, our scientists seek its enemy where it came from. The natural enemy of the boll weevil was an ant that could not endure our winters, but the native ant is getting busy.

The experiment stations of the several States are doing better work each succeeding year; the scientists are maturing and the people are appreciating.

The object lesson in agriculture is the best teacher; we had 60,000 of them at work last year.

Six hundred thousand short tons of beet sugar were made last year in 67 factories. There is an estimated world's shortage of 1,600,000 long tons of sugar this year.

The consumer pays a dollar for food; the farmer gets less than fifty cents for it. Who gets the rest?

All Government agencies that conserve public health should be grouped together in one bureau.

The Department of Agriculture has had success in the Southern States through object lessons in the fields, where the best southern farmers in their counties were the instructors. This method should be organized in all the States along lines of greatest necessity.

Our systems of renting land are faulty and result in soil robbing; where the renter can not provide domestic animals, the owner should arrange to furnish them so that rotation of crops may be had, and hay and grains may be fed on the farm.

Irrigation will bring maximum crops while the land is new and full of plant food; but, where the crops are sold year by year, irrigation will not of itself assure good results.

Alaska will some day provide farmers in lower latitudes with grain seeds superior to what they can grow at home.

The corn crop is moving northward by seed selection.

The southern farm boy is showing the way to grow more of all crops on an acre.

Educate the farmer's boy toward a more valuable life on the farm.

Uplift the farm home through the education of the farmer's daughter toward greater usefulness and attractiveness in the farm home.

Save all the liquid fertilizers on the farm, in cisterns, to be applied where crops are to grow; this will recover the greatest farm waste of our times.

There is great promise in the fact that whole classes of graduates of agricultural colleges go back to the farms, having learned how to make them profitable.

Our foresters are learning by experiments how to reforest 30,000 acres in a year; ten times as much must be planted annually to cover all the bare acres in a generation. It will be done.

There should be publicity regarding the cold storage of foods, through monthly reports to some Federal authority that would give them to the press, to the end that the people might know to what extent foods were being withdrawn from consumption.

CROP RESULTS.

ADVERSE CLIMATIC CONDITIONS.

EXCEEDING ALL RECORDS.

The climatic conditions of the early part of the growing season of 1911 were adverse to agriculture throughout the country east of the Rocky Mountains in a degree that exceeds all records. The assertion has been made that this country is so large in extent and has such a varied climate, soil, and crops that no nation-wide calamity can befall its farmers from natural causes. An extreme test of the truth of this assertion was made this year.

From early in May until July was well advanced, a period of about 60 days, a series of hot waves of marked severity so early in the summer followed one another in rapid succession over nearly the entire regions of the Mississippi Valley and the Atlantic coast.

Short periods of more moderate weather occurred locally at intervals, giving some relief, but, it is stated by the Weather Bureau, it is probable that during no previous similar period of 60 days has the temperature been so continuously and largely above the average over so extensive a region in the last half century.

Deficient rainfall made this continuous heat effective against crop production. From January to June the rainfall in Minnesota, Iowa, and Missouri was 19.7 per cent below the normal; it was 25.4 per cent below in North Dakota, South Dakota, Nebraska, and Kansas; 27.8 per cent below in New England; 12.4 per cent below in New York, New Jersey, and Pennsylvania. In the South Central States east of the Mississippi River the deficiency of rainfall from January to June was 10.3 per cent; west of that river, 21.6 per cent; and in the Pacific Northwest, 21.2 per cent.

This combination of drought and heat was the severest test to which the crops of the immense area covered have been subjected during the many years covered by records.

Yet 1911 is not a lean year. Enough has been produced for the national needs, and there will be a surplus.

COMPARISON UNFAVORABLE TO 1911.

CROP PRODUCTION.

Most of the crops of 1911, as far as their production is ascertained, compare unfavorably with the average production of the preceding five years. Cotton is the most conspicuous exception. If the commercial expectations of the size of this crop are realized, it will be one-quarter larger than the five-year average, and also the largest cotton crop ever grown.

The sugar-beet crop is much above the average production of the previous five years, and is the largest ever grown, while rice and buckwheat are considerably above.

All other crops are below the five-year average in production, hay being the most prominent one in percentage of deficiency.

VALUE OF WEALTH PRODUCED.

For the first time in many years the total value of farm products has declined from that of the preceding year. The estimate for 1911 is based on the census items and is $8,417,000,000, or $277,000,000 under the total for 1910. The loss is chargeable to the general classes of animal products and animals sold and slaughtered. Dairy cows are the only farm animals for which increase of price is indicated. Eggs, wool, butter, and poultry have likewise suffered in farm price during the year. In consequence of the decline of prices of farm animals and their products, this group is estimated as having produced a value of $2,913,000,000 in 1911, or $321,000,000 below the amount for 1910.

On the other hand, the crops are worth more than those of 1910, the estimate of farm value being $5,504,000,000, a gain of $44,000,000 over 1910. Farm prices of all crops are higher than for 1910, except for cotton, cotton seed, and flaxseed, and this general fact, notwithstanding the other general fact that production was low, makes about 10 crops of 1911 the most valuable ones of the same kinds that the farms of this country have ever produced.

If the census value of farm products for 1899 is represented by 100, the relative standing of subsequent years can be readily perceived if they also are represented by index numbers. After 1899 the total value of farm products increased yearly about 5 to 7 in the index number for six years, ending with 1905. For 1906 the increase was 10, for 1907 it was 15, for 1909 it was 16, for 1910 the increase was less than 2, and for this year there is a loss of 6 in the index number. At the end of six years after 1899, or the year 1905, the index number had risen from 100 to 133; in five years more it mounted to 183; and the highest point reached is 184.3 for 1910. The number for 1911 is 178.4. The progression was broken by this year, so that two other years, 1909 and 1910, exceed 1911 in the value of the wealth produced on farms.

Little is known of the total agricultural wealth production of foreign countries, but the little that is known affords interesting comparisons. A rough but official estimate of the value of the wealth produced by agriculture in Italy in 1910, a year of large production, is $1,351,000,000. Official returns of the production in Japan, averaged for the three years 1905–1907, give an annual value of a little more than $613,000,000. The official yearbook of the Commonwealth of Australia reports for 1908 a value of $484,000,000. According to the Canadian census of 1901 the value of the farm products of the foregoing year was $363,000,000; the census of 1911 has not yet published the corresponding figures for 1910, but the annual official report of agriculture indicates a present production valued at about $900,000,000.

CHIEF CROPS.

In the statement that follows concerning the crop quantities and values for 1911 no figures should be accepted as anticipating the final estimates of this department, to be made later. Only approximations can be adopted, such as could be made by any competent person outside of this department. All values are for products at the farm, unless otherwise stated, and in no item are values at the produce or commercial exchange.

CORN.

With a value more than twice that of the cotton crop this year, and but little less than the combined values of the cotton, wheat, and oats crops, corn is by far the leading crop as a wealth producer. The estimate of 2,776,000,000 bushels indicates a production that has been exceeded in only two years, but it is a little under the average for the preceding five years.

The farm price of corn is now higher than it has been since the records of the department began in 1866, except in 1883, and this establishes a total value for the crop that reaches $1,700,000,000 and breaks the record.

So preeminently is corn the leading crop of this country that about three-quarters of the world's crop is grown here. For the five years 1905–1909 the percentage is 76.2.

While the exports of corn as such from this country are small when comparison is made with the size of the crop, they averaged 67,400,000 bushels during the five years 1906–1910, and constitute one-third of the world's exports of corn.

This crop has secured a greater importance in national economy because of the multiplication of its uses. Formerly a feed for animals and as meal or hominy a food for man, it is now made into varied food products and finds numerous industrial uses, largely due to the work of the chemist.

COTTON.

That a large crop may be worth less to the producers than a small one is exemplified by the cotton crop of this year. Commonly supposed to be the largest one ever grown, this crop has reached a price that is 5 cents a pound of lint below that of last year, when the crop was much less in quantity, and for the same reason the price of seed has declined. Apparently, the value of the fiber and seed of this year's crop will not exceed $775,000,000, an amount that is below that of two former crops, although above the average of the preceding five years.

There is no crop that this country produces that excites such world-wide interest as cotton, for the reason that the crop of the United States is about three-fifths of the world's production, contributes two-thirds of the world's exports, and has a fiber of a sort that has no direct competition in other countries.

It is raw cotton, much more than any other commodity, that makes this country's export value loom large. This fiber contributes about one-half of the value of agricultural exports, and more than a quarter of that of all exports. During the fiscal year 1911, for the first time in history, the value of the exported cotton not only passed the half-billion mark, but reached the amount of $585,000,000, or $148,000,000 more than the average of the five preceding years.

HAY.

The considerable failure of the hay crop has caused an increase of farm price of only about $2.50 per ton over that of 1910. With a production of only 47,000,000 tons this year, this crop is far below the five-year average yield of 63,500,000 tons, and was exceeded by the crop of 1884 and every year since 1888.

The farm value of this year's crop, however, is slightly above the five-year average. In the case of some other kind of crop, three-quarters of the usual production would cause a much greater relative increase of price than is found in this crop, and the reasons why the hay price has not responded in greater degree are probably the good and late fall pasturage and the existence of a great deal of roughage to take the place of hay. The value of the crop is placed at a little less than $700,000,000, and this is $50,000,000 more than the assumed value of the cotton lint produced this year, and $100,000,000 more than the value of the wheat crop. These comparisons emphasize the importance of the hay crop, an importance that is not generally recognized off the farm.

WHEAT.

Fourth in order of value is the wheat crop, worth about $600,000,000, or a trifle below the five-year average and also below the value of the wheat crop of three other years. The farm price of wheat per bushel is a little above what it was last year, but is considerably below the price of 1909.

In production, the wheat crop of this year is 5½ per cent below the five-year average, and has been exceeded by that of every year since 1897, except in five years. The estimate of the department places the production at 656,000,000 bushels, an amount that would have been much exceeded had the weather conditions been favorable.

This country produced one-fifth of the world's wheat crop during the last five years, and contributed about one-eighth of the world's exports.

OATS.

The oats crop is invariably fifth in order of value, and this year is worth about $380,000,000, or 5 per cent more than the five-year average. This amount has been perceptibly exceeded in only one year. The farm price is about 10 cents a bushel higher than it was last year, on account of the deficient production.

The yield of this crop is estimated to be 874,000,000 bushels, a low amount caused by adverse weather. This was exceeded by the crop of every year since 1901, except three years. The oats crop of 1909 and of 1910 was more than a billion bushels. About one-fourth of the world's oats are grown in this country.

POTATOES.

The early prospect of an almost complete failure of the potato crop was not fully realized and the crop was ascertained to be 282,000,000 bushels, a production that was exceeded in seven years, and was 12 per cent below the five-year average.

Although the crop was about 90 per cent of the average production, the farm price increased 20 cents a bushel, or to about 75 cents, with the result that the total value of the crop is the highest of record, and amounts to $213,000,000, or 14 per cent above the five-year average.

BARLEY.

Barley is another crop deficient in production. The 146,000,000 bushels of this year's crop are 12 per cent below the five-year average, and also below the production of every year since 1905. But the total value of the crop is about $125,000,000, and much above the record value of 1907. This is because the farm price rose to about 85 cents a bushel, far above the price for every year since 1881, when it was 82.3 cents, and, with the exception of that year, far above the price for every year since 1874, when it was 86 cents. Since the record of the farm price of barley began in this department in 1866 the price of this year's crop per bushel has been exceeded in only three years.

TOBACCO.

The tobacco crop is 2 per cent under the five-year average in production and 5.3 under in value. From 1906 to 1909 the farm price of tobacco ranged from 10 to 10.3 cents a pound; in 1910 it was 9.3 cents; and for this year there is apparently an increase of a fraction of a cent. Previous to 1906, when the 10-cent price was first reached since 1887, there was a period during which there was a general complaint among tobacco growers that the price was too low, if not unprofitable.

The crop of this year is estimated to be about 800,000,000 pounds, worth about $76,000,000. The production has been larger in seven years and the total value in two years.

The tobacco grown in this country during the last five years is 31 per cent of the world's crop and supplied other countries with a quantity that is 42.3 per cent of the world's exports of tobacco.

FLAXSEED.

The flaxseed crop of 22,000,000 bushels has a farm value of about $47,000,000. The amount of the crop is 7½ per cent under the five-year average, and the total value makes the extraordinary comparison of 53 per cent above the five-year average. This is because the farm price increased from $1.01 in 1906 to $1.53 in 1909, to $2.31 in 1910, and to about $2.17 in 1911. The production of this year has been exceeded many times, but the total value has never been equaled.

RYE.

With the lowest production since 1901, except three years, the rye crop of about 31,000,000 bushels is 5.4 per cent below the five-year average. Its value, on the contrary, is the highest ever reached and is 12.2 per cent above the five-year average. Its farm value of about 83 cents a bushel is the highest since 1868, except 1881. The total value is $26,000,000.

SUGAR BEETS.

The sugar-beet crop, which for several years remained close to $20,000,000 in value, has risen to more than $24,000,000 this year, an increase of 23½ per cent above the five-year average and much above the previous highest value. The production also is the largest and is 23.7 per cent above the five-year average. To the establishment and growth of this crop this department has directed some of its best efforts.

HOPS.

No other crop exhibits such a high increase of value over the five-year average as the hop crop does. It is 140 per cent. This is because the price of hops, which has usually been 10 to 20 cents a pound, has risen to about 38 cents. Consequently the total crop value has become $15,500,000. The production, on the other hand, has fallen off by 15 per cent in comparison with the five-year average and has been exceeded many times.

Nearly one-fourth of the world's exports of hops go from this country, and a little over one-fourth of the world's crop is produced here.

RICE.

Rice is one of the five crops that have a production above the five-year average, the percentage being 6.6. The amount, although a little over 1,000,000,000 pounds, has been exceeded twice. The price per barrel has been down until within a very few weeks, and it is probable that the value of the crop, as finally determined, will be larger than was expected.

BUCKWHEAT.

Buckwheat continues to show a disposition to reach its old-time production after many years of decline. The crop of this year is 7.3 per cent above the five-year average and has been exceeded by only two crops since the sixties. The total value is the largest since the sixties and is above the five-year average by 13 per cent. The farm price is about 72 cents a bushel, and in only one year since 1883, namely, in 1908, has the price been higher.

TOTAL OF ALL CEREALS.

Notwithstanding the considerable differences among the cereals, a comparison of the total of all of them this year with the five-year average will be some sort of a measure of the year's performance in agriculture. The bushels of cereals produced this year number 4,522,000,000. This is 3.4 per cent below the five-year average and, while it indicates that the agricultural year of 1911 was below par, it is far from indicating any degree of calamity. If the great cotton crop be taken into account, the total crop production is below the average in a less degree than the cereals suggest.

SUGAR.

Sugar making belongs to manufacturing and not to agriculture, yet cane and beet production can best be treated through the sugar made from them. The refined beet sugar made this year nearly equals 600,000 short tons, the largest amount ever made by about 80,000 tons. This is about 24 per cent more than the five-year average. The value has, of course, soared and amounts to about $90,000,000, including value of pulp, the highest previous value being about $60,000,000 for 1909. It is 81 per cent above the five-year average.

The cane-sugar production of 1911 is estimated to be about 380,000 short tons of raw sugar, or about 5½ per cent above the five-year average production, but yet an amount that has been exceeded several years. The value is about $45,000,000, which is far above the highest figure ever before reached and is 58 per cent over the five-year average.

Both kinds of sugar combined, the production equals about 975,000 short tons, or about 85,000 tons more than the record production of 1909. The factory value of this sugar and the beet pulp, which is used for feeding purposes, is about $135,000,000, or about $41,000,000 more than the value of the two kinds of sugar for 1909, the year next to 1911 in order of value.

SUMMARY OF COMPARISONS.

The year 1911 was a poor one for record-breaking crops, since the list includes only cotton and sugar beets. In these cases, however, the achievements are memorable, because of the great increases over the production that was previously highest.

Apart from these two crops, not a crop reaches a place that is next to the highest production of former years; corn and rice win third place, and buckwheat third place since the sixties; the total of all cereals occupies fifth place, and the other crops are farther down the scale.

The tale is reversed when the values of the crops are considered. The crops that have won first place make a formidable list in spite of the fact that they had previous very high values to exceed. The list is corn, barley, rye, buckwheat (since the sixties), potatoes, hops, flaxseed, sugar beets (or beet sugar), and cane sugar. No other crop reached second place in order of value in comparison with other years, but the total value of all cereals and of all crops did. The crops that reach third place are hay, cotton, and tobacco. Wheat is fourth in value, and has been exceeded in this respect in three years.

The crops of this year compare with the average of the previous five years more favorably than they do with single years when results were highest. In the list of crops that had a production above the five-year average are cotton, rice, buckwheat, beet sugar, and cane sugar.

In value of crops, the five-year average was overtopped by corn, cotton, hay, oats, barley, potatoes, buckwheat, rye, flaxseed, hops, and beet and cane sugar.

FOREIGN TRADE IN AGRICULTURAL PRODUCTS.

BALANCE IN FAVOR OF EXPORTS.

CAUSED BY THE COTTON SURPLUS.

The large surplus of value of exports of domestic agricultural products over the value of imports of agricultural products, which has been the result of this country's foreign trade for many years, seemed to be threatened by the declining surpluses of 1909 and 1910; and by the same cause the balance of trade in favor of exports of all commodities, agricultural and otherwise, was threatened with extinction unless manufactures were exported in values large enough to prevent. In the fiscal year 1908 the balance in favor of this country was $488,000,000 in agricultural products; the next year it was $274,000,000; in 1910 the balance fell to $198,000,000. During the same years the balance in the trade of commodities other than agricultural in favor of exports fell from $178,000,000 to $77,000,000 the next year, and turned to a balance in favor of imports in 1910.

This tendency was sharply arrested in 1911, when the farmers' balance of foreign trade rose to somewhere near its former proportions. It was $366,000,000. In the same year the balance in favor of exports in the trade of commodities other than agricultural reached $156,000,000.

As the matter has stood for many years, the balance of trade in favor of exports, both of agricultural products and of all products, is mostly, if not entirely, due to raw cotton. That is to say, the value of the cotton exports are more or less approximate to the balance.

EXPORTS.

OVER A BILLION DOLLARS.

Three times has the total value of exports of domestic farm products been greater than a billion dollars—in 1907, 1908, and in 1911. The total for the last year—$1,031,000,000—is exceeded only by that of 1907, and then by only $23,000,000. More than half of the total export value is contributed by raw cotton, the value of which is $585,000,000.

Packing-house products gain $21,000,000 in value over their exports in 1910, and reach the figure of $157,000,000. But grain and grain products continue the decline which began in 1909 and have fallen to a value of $124,000,000, a loss of $91,000,000 in three years.

Tobacco continues to show exporting strength, and its value in 1911, $39,000,000, is $1,000,000 above the previous year. The same is true of fruits, with their value of $24,000,000, or $5,000,000 over 1910.

The exports of live animals have dwindled to $19,000,000, which, however, is a gain of $2,000,000 over 1910. Oil cake and oil-cake meal exports remain as the year before at $20,000,000. but vegetable oils have risen $3,000,000 to a value of $20,000,000.

IMPORTS.

RECORD ALMOST BROKEN.

By falling short only $8,000,000 the imports of agricultural products in 1911 failed to go above the highest record, in 1910. The value for 1911 is $679,000,000.

The imported silk fiber was valued at $75,000,000; coffee, $91,000,000; vegetable fibers, $56,000,000; seeds, $30,000,000; fruits, $27,000,000—all with increases over the values of 1910.

Declining from the previous year, the imports of wool in 1911 were valued at $23,000,000; packing-house products, largely hides and skins, $84,000,000; sugar and molasses, $98,000,000.

FOREST PRODUCTS.

HIGH VALUES.

The value of exports of domestic forest products continues to advance and the amount for 1911, $103,000,000, is the highest yet reached. The exported lumber was valued at $60,000,000; timber and logs, $17,000,000; the naval stores, $25,000,000.

The imports of forest products in 1911 were valued at $164,000,000, and came within $15,000,000 of equaling the total of 1910, which holds the highest place. India rubber was imported to the value of $76,000,000; other gums, $26,000,000; lumber, $21,000,000; wood pulp, $14,000,000, an import that has doubled in value in four years.

THE AGRICULTURAL SURPLUS.

TREND OF EXPORTS.

Coincident with the geographic expansion of agriculture on the new land of this country the exports of farm products grew in quantity. That was a period when immigrants became farmers, and farmers' sons established farms on what had been the public domain.

After a long time the new land that was fit for agriculture and could be acquired diminished, agricultural land values increased, the immigrants changed in description and were not inclined to agriculture, and the farmers' sons went to town and city. So National consumption increased in the later time in a greater degree than agricultural production did.

This is the broad, general view of the matter, although there have been many variations and readjustments in particular instances; and, in consequence of the new order of affairs, the exports of agricultural products have diminished in quantity because the National surplus has become less. They have increased in value because prices have risen.

Not all products have diminished in exports. Improved agriculture and the ability and disposition of farmers to produce for the foreign market have increased the National surplus of some products and indicate potentialities that will be beyond the requirements of National sustenance for an indefinite time.

EXAMINATION OF PRODUCTS.

A detailed examination of the export statistics of the Department of Commerce and Labor discovers what the trend has been in the quantities of the National surplus of agricultural products. Let the exports of the 10 years 1900–1909 stand for 100, and the exports of each year or group of years can be related to 100 for a simple and easily understood comparison.

The cattle exports of the 10 years 1900–1909 being 100, those of 1870–1879 were 12.4. The index number rose to 85.3 in 1890–1899 and to 102.6 in the five years 1900–1904, from which time the decline was to 34.3 in the single year 1911.

The exports of horses, mules, and sheep reached their highest figure in 1900–1904. Swine eventually met adverse legislation on the continent of Europe, and their exports declined from 236.5 in 1870–1879 to 31.7 in 1911.

Butter exports were highest in 1880–1889, for which period they are represented by 141.7, and fell to 35 in 1911. Cheese exports declined enormously from the highest figure, 494.8, in 1880–1889, to 47.8 in 1911. On the contrary, eggs have displayed a climbing tendency and have risen from 0.8 in 1870–1879 to 127 in the five years 1905–1909, and to 199.9 in 1911.

All beef and its products have been combined as far as they are ascertainable in pounds, and then it appears that the period of highest exports was the five years 1900–1904, the index number being 103. It was 43 in 1911. Canned beef was highest at 135.8 in 1890–1899 and fell to 21.9 in 1911; fresh beef dropped from 116.1 in 1900–1904 to 16.1 in 1911; oleomargarine, oleo oil, tallow, and salted and pickled beef were all highest in the five years 1905–1909.

The total for pork and its products reached the highest export mark, 102.2, in 1900–1904, and fell to 65.9 in 1911. Some pork exports were highest in 1905–1909, and these were salted and pickled pork and lard.

Lard compounds are represented by 16.8 in 1893–1899, by 68 in 1900–1904, by 132 in 1905–1909, and by 135.5 in 1911. Mutton also is able to increase its exports, and at the end of the period of 42 years under examination has the index number 164. Again, in the case of animal oils not specially named, there is a similar tendency, and the number for 1911 is 226.

In the case of cotton the exports were 35.7 in 1870–1879, and the number steadily rose to 110.9 in the five years 1905–1909. It was 85.7 in 1910 and 107.8 in 1911.

Dried apples gained steadily until 101.1 was reached in 1905–1909, and fell to 64.6 in 1911, but fresh apples have gained to the last year, for which the number is 146.7. Both prunes and raisins have an upward tendency to 1911, the former being represented by 133.8 and the latter by 367.1. Glucose and grape sugar may be added to the list of products with gaining exports.

Barley has fallen from 109.9 in 1900–1904 to 89.1 in 1911; corn and corn meal, from 117.8 in 1900–1904 to 69.3 in 1911; oats, from 123.4 to 13.4; rye and rye flour, from 139.5 to 2; wheat, from 131.8 to 28.6; wheat flour, from 118.8 to 65.5. Bread and biscuit had highest exports, 124.8 in 1880–1884, and after a decline to 96.1 in 1905–1909 rose to 111.1 in 1911.

Hay declined from 111.8 in 1900–1904 to 72.2 in 1911; cotton seed, from 120 to 37.1; clover seed, from 133.3 to 39.7; beans and pease, from 102 to 77.8.

On the contrary, corn-oil cake has advanced to 164.1 in 1905–1909 and to 275 in 1911; hops to 115.5 in 1905–1909; cottonseed oil cake and oil-cake meal to 104.4 in 1905–1909; flaxseed, oil cake, and oil-cake meal to 110.7; cottonseed oil to 108.4; linseed oil to 134.3; rice to 165.8; rice bran, meal, and polish to 106.6; flaxseed to 110.2; timothy seed to 123.1; onions to 125.2; potatoes to 124.9 in 1905–1909 and to 262.9 in 1911.

Tobacco had the index number 85.4 in 1890–1899; 101.1 in 1900–1904; 98.9 in 1905–1909; 110 in 1910; and 109.4 in 1911.

SUMMARY.

The numbers quoted in the foregoing presentation may be regarded as fairly indicating the upward or downward tendency of exports of the products mentioned.

Most of the cereals and their products, all of the animals, and most of the meats and their products are going down in quantity of exports, and these three great general classes of products have filled a large place in the body of exports. Only mutton and unspecified animal oils, rice and its bran, meal, and polish, corn-oil cake, glucose and grape sugar, and perhaps bread and biscuit in these three great groups of exports display a tendency to increase.

A long record of increase is presented by cotton, hops, and tobacco. Comparatively recent products have joined the old list and give evidence of increase. Among these are cottonseed oil and flaxseed and cottonseed oil cake and oil-cake meal, linseed oil, flaxseed, and lard compounds. Among the fruits that are gaining are prunes, raisins, and fresh apples, and among the vegetables are onions and potatoes.

ECONOMIC RESULTS OF COLD STORAGE.

SPECIAL INVESTIGATION BY THE DEPARTMENT.

REASONS FOR THE UNDERTAKING.

Investigations of cold storage have heretofore been directed toward the subject from the point of view of the pure-food advocate. Legislation, actual and proposed, assumes that foods are kept in cold storage in large quantities for long periods of time, so long that the qualities of the foods deteriorate. Particular instances of storage for periods longer than a year and even two years have had prominent publicity and the inference has been drawn that such long-time storage is common. The cold-storage men were not believed when they asserted that the time of storage was usually not excessive. It has been charged against them, too, that they use cold storage for speculation and for squeezing consumers.

Because of lack of information with regard to the management of cold storage and in view of some current criticisms of the business this department made an investigation in September and October of this year.

METHOD OF PROCEDURE.

Schedules were prepared for statements of quantities of receipts of fresh beef, mutton, and pork; of dressed poultry, butter, and eggs, and of fresh and frozen fish during each month during a period of two years. The period began with March, 1909, for dressed poultry, eggs, and fish; with May, 1909, for the other commodities.

The schedules also provided for a statement of the deliveries each month out of storage to the end of August, 1911, against the receipts of each month.

Another schedule was designed for a report of the charges of storage and of the weights of packages.

The bulk of the cold-storage business is carried on in towns and cities where the Bureau of Animal Industry performs meat inspection, and at all of these places the inspectors in charge were requested to apply to the owners or managers of cold-storage warehouses, whether public or private, for the information indicated by the schedules. Warehouses outside of the area of the jurisdiction of the inspectors were approached by mail. The services of the Bureau of Animal Industry in this undertaking were performed with fidelity and with as high a degree of thoroughness as the local circumstances permitted.

The schedules that were returned were placed in charge of the Bureau of Statistics of this department for tabulation and the derivation of such results as could be extracted from them.

It appeared in the progress of the undertaking that many warehouses did not keep their records in such form as to permit the making of the statements requested, or at any rate not without a practically impossible amount of work. Many of the warehousemen made the reports after weeks of laborious efforts. With two or three exceptions, the disposition of the warehousemen was to make the reports and to give publicity to the features of their business provided for in the schedules.

It may not be generally understood that cold-storage warehousemen who do a public business rent space to the owners of commodities. The goods stored are owned by the customers and not by the warehousemen. In private warehouses, such as are owned and used by the meat packers, the commodities stored are owned by themselves.

COMPILATION OF PRICES FOR 30 YEARS.

In connection with the application to the cold-storage warehousemen for statements, several experts in the Bureau of Statistics exhausted the resources of the library of this department and of Congress, and the libraries of other departments, in collecting wholesale-price quotations of the commodities included in the investigation. The first quoted price of each month was taken as far back as October, 1880, and from that time to October, 1911. During this period of 30 years grades have changed, and also the quoted grades. Error due to this fact was avoided by taking prices for grades that remained uniform from October to October of the next year, since the series of 13 prices for each year, October to October, was to be converted to index numbers based on the mean monthly price for the year. The purpose of this compilation was to observe fluctuations before cold storage existed or was of considerable account, and to compare with fluctuations in recent years, during which this business has grown to large proportions.

IMPORTANT CONCLUSIONS WARRANTED.

Out of the great mass of details contributed by the warehousemen and obtained by the price experts and out of the profusion of the derived results extracts are made for concise and pointed conclusions. The information obtained is sufficient to alter some old views with regard to cold storage, and it also establishes new ones.

LENGTH OF TIME IN STORAGE.

PRINCIPAL MONTHS WHEN COMMODITIES ARE RECEIVED.

Warehousemen were requested not to include in their reports commodities whose owners intended to keep them in cold storage only a few days and to make no report for a warehouse doing only a temporary accommodation business. No reports, also, were to be made for fresh meats in coolers; nor was the time passed in coolers to be added to the time in cold storage proper.

The two years covered by the investigation begin with March for dressed poultry, eggs, and fish; with May for fresh beef, mutton, and pork and butter.

The principal months when fresh beef is placed in cold storage are September, October, and November; mutton, August, September, and October; butter, June, July, and August, and sometimes May; eggs, April, May, and June. Pork is quite well distributed throughout the year, and the prominence of winter in the receipts into cold storage is barely perceptible. Poultry is made up of diverse elements. Broilers go into storage from the latter part of August until November and roasters from October to December. There are besides the different varieties of poultry. November, December, and January, and sometimes October, are the heaviest storage months.

With regard to fish, there seems to be no regularity in the heavy months; the three heaviest months in the year beginning with March, 1909, were August, November, and January, but in the following year the months were April, July, and December. The kinds of fish that go into cold storage are seasonable, and the natural supply does not last throughout the year. There are also often two storages for fish. In the initial one the fish is received fresh at the place where caught and kept a length of time determined by circumstances. This place is not usually one of consumption, so that in that event the fish is transferred frozen to cold storage at a place where it is to be consumed. In this investigation the two storages are added together in stating time of storage.

During the three heavier cold-storage months of 1910–11, 47 per cent of the fresh beef placed in cold storage during the whole year was received into the warehouses; 59.8 per cent of the fresh mutton; 59.2 per cent of the dressed poultry; 70 per cent of the butter; and 79.4 per cent of the eggs

DELIVERY WITHIN SPECIFIED NUMBER OF MONTHS.

"Delivery" is the word used in the business to indicate a taking out of storage, because the deposit is delivered back to the owner.

The New York cold-storage law of this year limits the storage of foods to 10 months, except that butter may remain for 12 months. The New Jersey law of this year fixes a limit of 10 months. The Heyburn bill assigns a limit of seven months to fresh beef, four months to veal, pork, and mutton, and three months to lamb, poultry, game, fish, eggs, and butter.

It is established by this investigation that 71.2 per cent of the fresh beef received into cold storage in the year 1909–10 was delivered within three months, 28.8 per cent of the fresh mutton, 95.2 per cent of the fresh pork, 75.7 per cent of the poultry, 40.2 per cent of the butter, 14.3 per cent of the eggs, and 35.5 per cent of the fish.

Within four months after it was received 86 per cent of the fresh beef was delivered, 42.7 per cent of the fresh mutton, 96.5 per cent of the fresh pork, 85.3 per cent of the poultry, 53.4 per cent of the butter, 22.6 per cent of the eggs, and 49.5 per cent of the fish.

The percentage of receipts delivered in seven months is 99 for fresh beef, 99.3 per cent for fresh mutton, 99.9 per cent for fresh pork, 96.1 per cent for poultry, 88.4 per cent for butter, 75.8 per cent for eggs, and 64.9 per cent for fish.

Lastly, let the percentages for the deliveries of 10 months be stated. These are represented by 99.7 per cent for fresh beef, 100 per cent for fresh mutton and pork, 98.9 per cent for poultry, 97.8 per cent for butter, 99.9 per cent for eggs, and 77.5 per cent for fish.

It is possible to parallel the above statement with one for the following year, 1910–1911, for the deliveries of three and four months, but not for a longer time. The figures for three and four months are most of them considerably below those quoted for 1909–10.

The important observation to be made is that the receipts into cold storage are entirely or very nearly exhausted by the deliveries within 10 months.

PERCENTAGE OF RECEIPTS HELD LONGER THAN A YEAR.

So common is the belief that large quantites of food are held in cold storage for more than a year that it is worth while to learn what fraction of the receipts of the warehouses embraced in this investigation has been in storage longer than 12½ months. In March, 1909, poultry was placed in some of these warehouses; on September 1, 1911, 29½ months afterwards, not any remained. All of the other commodities covered by this investigation had been delivered. The same fact applies to the commodities received 28½ months before.

In one warehouse there was discovered some fresh mutton that had been in cold storage for $27\frac{1}{2}$ months, and this was 10.2 per cent of the fresh-mutton receipts of all reporting warehouses for May, 1909. Of the receipts of butter in that month, 0.3 of 1 per cent remained September 1, 1911.

So, determining the percentages in a similar manner, it was found that 0.1 of 1 per cent of the receipts of poultry for a month was still in cold storage at the end of $26\frac{1}{2}$ months and 0.3 of 1 per cent in the case of butter.

For a storage of $21\frac{1}{2}$ months, fresh mutton is represented by 0.8 of 1 per cent and poultry by 0.4 of 1 per cent. Poultry has 0.1 of 1 per cent for $19\frac{1}{2}$ months, 0.2 of 1 per cent for $18\frac{1}{2}$ months, 0.1 of 1 per cent for $17\frac{1}{2}$ months, less than 0.05 of 1 per cent for $16\frac{1}{2}$ months. For $16\frac{1}{2}$ months butter has 0.5 of 1 per cent and for $15\frac{1}{2}$ months 3.3 per cent, while mutton for the last period has 0.5 of 1 per cent.

For $14\frac{1}{2}$ months in cold storage, 0.1 of 1 per cent stands for fresh mutton, less than 0.05 of 1 per cent for poultry, 3.5 per cent for butter, and 0.1 of 1 per cent for fish.

Fresh beef had 0.1 of 1 per cent still in cold storage at the end of $13\frac{1}{2}$ months; fresh mutton, 2.2 per cent; fresh pork, less than 0.05 of 1 per cent; poultry, 1.3 per cent; butter, 6.6 per cent; and fish, 10.5 per cent.

At the end of $12\frac{1}{2}$ months fresh beef had 0.5 of 1 per cent in storage; fresh mutton, 0.6 of 1 per cent; fresh pork, less than 0.05 of 1 per cent; poultry, 0.2 of 1 per cent; butter, 6.5 per cent; and fish, 13 per cent.

This statement covers all of these commodities held in cold storage longer than $12\frac{1}{2}$ months. Warehousemen explain excessively long storages by stating that they are caused by lawsuits and other circumstances of an uncommercial nature.

AVERAGE LENGTH OF STORAGE.

Since the receipts and deliveries were reported by warehousemen for each month, it is easy to compute the average time of storage. The fresh beef received into storage during the year beginning with May, 1909, was kept there on the average for 2.3 months; the fresh mutton, 4.4 months; the fresh pork, 0.9 of 1 month; and the butter, 4.4 months. The poultry received during the year beginning with March, 1909, was kept on the average 2.4 months; the eggs, 5.9 months; and the fish, 6.7 months.

The average time of storage differs as between the first and the second half of the year adopted for the purposes of this investigation. The average time for fresh beef in the first half of the year is 2.6 months, in the second half 1.8 months; fresh mutton in the first half

4.8 months, in the second half 3 months; fresh pork in the first half 0.8 of 1 month, in the second half 1 month; poultry in the first half 2.6 months, in the second half 2.4 months; butter in the first half 4.5 months, in the second half 4 months; eggs in the first half 6.1 months, in the second half 1.7 months; fish in the first half 6.8 months, in the second half 6.7 months.

COSTS OF STORAGE.

STORAGE CHARGE, INTEREST, AND INSURANCE.

In the foregoing treatment of the information obtained with respect to the length of time commodities are held in cold storage, the subject has been examined from several viewpoints. It is apparent that long storage is exceptional.

The costs of cold storage are running against the prices of the commodities month by month. The owners must use good judgment and take their goods out of storage before the costs of storage, added to the original cost of the goods and some profit, will raise the total amount of cost above the market price. It is a problem of the future. Sometimes the owner of the goods errs in judgment and fails to make a profit, again he fails to get back the cost of goods and the costs of storage, and yet again he gets back all costs and a large rate of profit.

The warehouseman has a rate of charge for space for each commodity, in some cases for storing for the "season," and in others by the month. Another cost of storage is interest, which is not always a theoretical cost, because the owners of the commodities often borrow money on the security of their warehouse receipts, or otherwise. A third cost is insurance.

If these three costs are combined they amount to 0.437 of 1 cent per pound of fresh beef per month, or 3.5 per cent of the mean wholesale price of beef from September to November, 1910, the latest period of heavy warehouse receipts within the period covered by this investigation; for fresh mutton the costs are 0.352 of 1 cent per pound, or 3.8 per cent of the mean wholesale price in the heavy storage months, August to October, 1910; for fresh pork, 0.398 of 1 cent per pound, or 3.7 per cent of the mean wholesale price of January and February, 1911; for poultry, 0.446 of 1 cent per pound, or 2.8 per cent of the mean wholesale price of the largest class of poultry during October, 1910, to January, 1911; for butter, 0.571 of 1 cent per pound, or 2.4 per cent of the mean wholesale price of butter during June to August, 1911; and for eggs, the costs amount to 0.593 of 1 cent per dozen, or 3 per cent of the mean wholesale price of eggs, April to June, 1910.

The wholesale prices adopted for these commodities are the means of a few cities in all parts of the country.

It is evident that as the time of storage lengthens the costs and their percentage of the wholesale price must be multiplied by the number of months. If the storage is for 15 months, for instance, the cost per pound ranges from 5.273 cents for fresh mutton to 8.572 cents for butter, and is 8.898 cents per dozen for eggs; the costs for 15 months range from 36.5 per cent of the wholesale price in the case of butter to 57.5 per cent in the case of fresh mutton.

For the average length of time in cold storage, as ascertained in this investigation, the actual costs are: For fresh beef, 0.997 of 1 cent per pound; fresh mutton, 1.564 cents per pound; fresh pork, 0.350 of 1 cent per pound; for poultry, 1.079 cents per pound; for butter, 2.532 cents per pound; for eggs, 3.505 cents a dozen.

The costs of storage for the average length of time are 7.9 per cent of the wholesale price for fresh beef; 17.1 per cent for fresh mutton; 3.2 per cent for fresh pork; 6.8 per cent for poultry; 10.8 per cent for butter, and 18 per cent for eggs.

Approximately the wholesale prices of the commodities mentioned are increased by cold storage to the extent of the percentages just given.

CHANGES IN CONSUMPTION CAUSED BY COLD STORAGE.

Before the advent of cold storage there was a relative monthly consumption of commodities, such as the foods now stored, throughout the year which was adapted to the current supply, and that supply was more or less closely related in time to the production.

Cold storage has interposed to change considerably the relative monthly consumption and to make it more even throughout the year. To illustrate with a supposition, if 1 per cent of the total amount of eggs consumed in a whole year were consumed in December before the day of cold storage, perhaps 3 per cent is the figure for the present time.

There has also been a change in relative monthly prices, due to cold storage. In the case of eggs the relative price has increased in the season of natural plenty and diminished in the period of natural scarcity.

These two facts, the changes in the relative monthly consumption and prices upon passing to the cold-storage period, have been arithmetically related to each other for eggs and butter to discover the effect on the mean price for the year. It is not an undertaking that can be worked out with precision and can be only indicative.

The results are that in the cases of both butter and eggs the annual price level has been raised by cold storage, for a reason apart from the costs.

In two ways, then, cold storage has raised the cost of living.

TENDENCY TO UNIFORMITY OF PRICES THROUGHOUT THE YEAR.

THIS RESULT NOT ALWAYS INDICATED.

The prices of commodities compiled for use in this investigation begin with October, 1880, and end with October, 1911, a period of 30 years. It is the opinion of men who are well informed that at about 1893 the quantities of the commodities covered by this investigation that were placed in cold storage were large enough relative to the total supply to have perceptible influence on prices. For this reason the prices, which are the first quoted ones for each month, are reduced to a mean for the period beginning with October, 1880, and ending with October, 1893. In this period are found conditions as they existed before the advent of cold storage.

The cold-storage period is subdivided in order that the prices of the later years may be observed. The second period adopted extends from October, 1893, to October, 1902, and the third one from October, 1902, to October, 1911. The prices of each period have been reduced to a mean for each month, as in the case of the first period.

The next step is the conversion of the mean price of the first of each month for each group of years into a percentage of the mean for the year. This gives index numbers that very much facilitate an understanding of the subject.

It is evident, if the percentages, or index numbers, are 100 for all months, that there is complete uniformity of prices throughout the year. Therefore a tendency toward uniformity of prices is a tendency toward 100, whether the index number is above or below 100.

In comparing the first period with the last it appears that there was a tendency toward uniformity of prices in the case of butter in 11 out of the 13 months, or much more than half; in the case of eggs and fresh mutton in 9 months; poultry, 8 months. Less than half of the months exhibit this tendency in the cases of the other commodities—5 months for fresh pork and 3 months for beef.

If the second and third periods are compared, it appears that under the régime of cold storage there has been a tendency toward uniformity of prices for butter, eggs, and fresh mutton; away from uniformity for fresh beef and fresh pork; and no change for poultry.

Another aspect of the matter may be had by noting the range of prices for the three periods.

For butter the difference between the highest and lowest index numbers is 43.3 for the first period, 29.4 for the second, and 24.1 for the third. An approach toward uniformity is apparent, because the range between highest and lowest prices diminishes.

In the case of butter the range of prices increases from 72.3 for the first period to 74.6 for the second, but declines to 63.4 for the third.

An unbroken tendency toward uniformity appears in the case of poultry, since the range between highest and lowest prices diminishes from 28.9 for the first period to 23.5 for the second and to 15.9 for the third.

Both fresh beef and fresh pork seem to have been subject to less uniformity of prices in the third period than in the first, as indicated by increasing range between highest and lowest. The range for beef rose from 8.2 in the first period to 9.4 in the second and to 14.3 in the third.

The range for pork fell from 14.4 in the first period to 14 in the second, but rose above the first to 16.7 in the third.

The foregoing examination of range of prices substantially indorses the other process in pronouncing in favor of a tendency toward uniformity of prices with regard to butter, eggs, poultry, and fresh mutton, and of a tendency away from uniformity with regard to fresh beef and fresh pork.

SPECULATION.

EVIDENCE THAT IT SOMETIMES EXISTS.

An examination of the record of the prices of commodities prepared for this investigation gives a suspicion that there has been much speculation in some years by the men who keep them in cold storage. One illustration may be given. The egg year 1910–11 had 29 per cent more eggs in cold storage than the preceding year, and yet the price index number went much higher in the months when it is high—October to January—and much lower in the months when it is low—March to July following.

At a time when there was a plenty of eggs in storage the wholesale price of eggs soared to 43 cents in Boston in November and December and to 45½ cents in New York for near-by State eggs. There was an apparent mistake of the storage men in overestimating the consumption of the public at exorbitant prices, because so large was the unsold quantity at the beginning of the next egg year in the spring of 1911 that the wholesale price of eggs fell in April to 18½ cents in Boston and New York, and the storage men dumped so much on the foreign market as to make the greatest quantity of eggs ever exported from this country in a year.

STORED GOODS AS A PERCENTAGE OF CONSUMPTION.

LARGE ENOUGH TO BE OF PUBLIC CONCERN.

This business of storing foods has grown to such proportions that consumers have a rightful concern with its management for economic as well as sanitary reasons. From the returns made to this department by the cold-storage warehousemen, it is inferable that the fresh beef, fresh mutton, fresh pork, poultry, butter, eggs, and fish received into cold storage in a year amounts to a weight of at least 1,000,000,000 pounds and very likely to a quarter of a billion more.

The eggs received into storage in a year are approximately 13½ per cent of the farm production; the fresh beef is over 3 per cent of the census commercial slaughter of cattle; mutton over 4 per cent of that slaughter of sheep and lambs; fresh pork 11½ per cent of that slaughter of hogs; and butter 25 per cent of the creamery production.

RECOMMENDATION.

PUBLICITY.

This is no indictment of the men who keep foods in cold storage, except in so far as they sometimes speculate, nor need they be indicted for offenses in order that the public economic interest in their business may be made to appear. The foregoing matter, it may be supposed, establishes that. The man who places food in cold storage is somewhat in the situation of the man who forestalls the market. He may not attempt to do so, but the power may be a temptation.

The affairs of such a business as this should have publicity. The public ought to know how much goods are in storage from month to month and what the movements of receipts and deliveries are.

The food warehousemen should be required to send to Washington monthly reports containing the desired information. Here these reports could be promptly aggregated and the results could be given to the public on a previously announced day of the month, somewhat as the crop reports are.

WORK OF THE DEPARTMENT IN 1911.

IMPROVEMENT IN BUSINESS METHODS.

On September 20, 1910, I appointed a committee on economy and efficiency to investigate business methods in the department and to report to me such changes as might seem desirable. After a very comprehensive and thorough inquiry this committee reported that in the main the business methods of the department are economical, adequate, and efficient. Some changes were recommended, which were approved by me and became effective June 21, 1911. While this inquiry was in progress, the committee cooperated to the fullest extent possible with the President's committee on economy and efficiency, and a great deal of critical, analytical, and constructive work was done, and full reports were furnished to the President's committee by the departmental committee and by the various bureaus, divisions, and offices.

CHANGES IN PERSONNEL.

The number of officers and employees on the rolls of the department July 1, 1911, as shown by the report of the Appointment Clerk, is 224 in excess of the number reported for the fiscal year 1910. The employees located in Washington number 2,514, while 10,190 are employed elsewhere. During the year 57,884 changes of every description were made, including the appointment of 33,709 fire fighters in the Forest Service, employed for brief periods, none exceeding six months. The number of persons receiving probationary appointment (equivalent to absolute appointment if the appointee is retained in the service after the probationary period) was 1,168. Ninety persons were reinstated and 60 were transferred from other departments; 694 resigned; 56 died in the service; and 42 were dismissed because of misconduct.

On July 1, 1911, there were 4,068 officers and employees on the statutory roll (comprising positions specifically appropriated for by Congress), and 8,636 were paid from lump-sum appropriations, making a total enrollment of 12,704, not including the temporary employees appointed after January 1, 1911, nor temporary field employees.

OFFICE OF THE SOLICITOR.

The fiscal year 1911 marked the period of the greatest activity in the Office of the Solicitor since its creation in 1905. During the year the administrative machinery for carrying out the several regulative acts of Congress enforced through the department has increased in efficiency. The duties of the department under these acts are becoming more sharply defined and better understood; as a result the duties and responsibilities of the Office of the Solicitor have been very largely increased. The more important of these acts of Congress are the statutes regarding the occupancy and use of the National Forests, the meat-inspection law, the food and drugs act, the 28-hour law, the live-stock quarantine act, and the Lacey Act. The normal expansion along existing lines of activity in other branches of the department has also contributed greatly to the volume of the work of this office. The legal work of the Forest Service was placed under the immediate direction of the Solicitor on January 15, 1910, and in the report for the fiscal year 1911 there is included for the first time a statement of the legal work performed by this office on behalf of the Forest Service during a full fiscal year.

WORK FOR FOREST SERVICE.

The legal work transacted on behalf of the Forest Service falls naturally into the following divisions: Opinions, contracts, claims, regulations, trespass cases, general litigation, and hydroelectric power permits. The subject "trespass cases" resolves itself into four subdivisions: Grazing, timber, fire, and occupancy cases. During the fiscal year 1911 the Solicitor rendered 56 formal opinions, in writing, to officers of the Forest Service on the legal phases of questions arising in connection with the administration of the National Forests. Four hundred and twenty-three agreements and 196 leases were prepared, and the sufficiency of the execution of the same examined during the fiscal year 1911. More than 2,300 cases involving claims to land within the National Forests have been considered by the office during the year. Twenty-four cases as a basis for criminal prosecution and 12 actions for injunctions as a result of grazing trespasses were reported to the Attorney General. Cordial cooperation with the Interior Department has contributed to the efficient administration of the National Forests. In two cases of timber trespass, decided during the year, the Government recovered $47,000. Railroad companies operating through the National Forests have been compelled by the courts to live up to stipulations for the protection of the forests against fire and other damage. The important case of the United States *v.* Grimaud, in which the Supreme Court of the United States had divided upon a previous argument, was again presented to the court and a unanimous decision of far-reaching effect was secured, approving the administration of the National Forests through the regulations of the Secretary, and sustaining the right of the Government to enforce such regulations by criminal prosecution. Regulations regarding the occupancy of lands in National Forests, the subjects of grazing, special uses, trespass, and timber sales were revised during the year.

MEAT-INSPECTION LAW.

One hundred and one violations of the meat-inspection amendment were reported to the Attorney General in the fiscal year 1911. Forty-three cases terminated in favor of the Government during the same period, fines or sentences of imprisonment being imposed, the fines amounting to $3,240. In one case there was a verdict for the defendant, eight cases were dismissed, sentence was suspended in three cases, and in four instances no true bill was returned. Seventy-four cases arising under this statute were pending at the close of June 30, 1911.

FOOD AND DRUGS ACT.

The food and drugs act has been effectively enforced during the year by the department and the United States attorneys. Cordial cooperation has existed between this department and the Department of Justice. The prime object of the food and drugs act was declared in the report (No. 1780, 61st Cong., 1st sess.) of the House

Committee on Expenditures in the Department of Agriculture to be the securing of wholesome food and properly labeled drugs for the people at large. No leniency has been shown in any case based on foods alleged by the Bureau of Chemistry to contain added poisonous or deleterious ingredients which might render them injurious to health. Eight hundred and twenty-five cases were reported for criminal prosecution, and 337 seizures of adulterated and misbranded foods and drugs were recommended; making 1,162 cases or 40 per cent of the whole number of cases reported since the act went into effect on January 1, 1907. There were 683 cases prosecuted by the United States attorneys or about 50 per cent of all the cases brought to judgment up to June 30, 1911. About $16,000 was the amount of the fines imposed, and costs were generally assessed against the defendants. Decrees of condemnation and forfeiture were entered against over 275 shipments of adulterated and misbranded foods and drugs, and it was insisted that in every case where foods were found to consist of filthy, decomposed, or putrid substances or to contain poisonous or deleterious ingredients orders be entered directing the destruction of the goods.

Cooperation with the department by some of the State food and drug officials has continued throughout the year, and cases based upon samples collected and examined by the collaborating officials have been reported to the Attorney General after being considered by the department when the results of the investigations have warranted such action.

Two important cases under the food and drugs act were decided by the Supreme Court during the year. The first was Hipolite Egg Co. *v.* United States. The case grew out of the seizure of 50 cans of preserved eggs under section 10 of the act in the southern district of Illinois. A decree of condemnation and forfeiture, with costs, was entered by the trial court, and the Hipolite Egg Co. appealed, asserting that the court was without jurisdiction because the eggs had not been shipped for sale within the meaning of the food and drugs act, and, further, that the court was without jurisdiction to assess the costs of the proceedings against the claimant. The decree below was affirmed, and the Supreme Court held that adulterated articles of food which have been transported in interstate commerce are subject to seizure and condemnation as long as they remain in the condition in which they were transported—that is, "in the original unbroken packages." The jurisdiction of the district court to assess costs was also upheld.

In United States *v.* Johnson the decision was adverse to the Government. In this case misbranding was alleged of a so-called "mild combination treatment for cancer," consisting of several packages bearing statements that the treatment would effect the cure of cancer. The indictment alleged that these representations were false and misleading statements regarding the article and that the drug was misbranded, because analysis showed the treatment to be worthless and ineffective for the pretended purpose. On defendant's motion to quash, the district court for the western district of Missouri held that inquiry under the food and drugs act does not extend to the question whether a product is effective or worthless to accomplish the results claimed for it on the label. The judgment of the district court was affirmed by the Supreme Court. Following this decision the President sent a message to Congress urging the immediate necessity for remedial legislation.

TWENTY-EIGHT-HOUR LAW.

Under the 28-hour law 598 instances of apparent violations were reported, 350 cases were disposed of, and 30 cases were decided adversely to the United States. Penalties aggregating $26,075 and costs amounting to $5,783.85 were imposed. Eight hundred and seven cases were pending under this statute at the close of June 30, 1911. During the fiscal year a number of important decisions of the Federal courts were handed down in cases arising under this statute, the most important being the opinion of the Supreme Court of the United States in Baltimore & Ohio Southwestern Railroad Co. *v.* United States, in which the unit of violation under the statute was finally determined. The opinion of the Supreme Court makes the number of penalties dependent upon the number of times a carrier fails to comply with the statutory duty to unload, whether the particular group of animals not unloaded be one shipment or a trainload of stock. The tendency of courts to assess larger penalties than previously is noteworthy. In only 19 cases was a penalty over $100 assessed in 1910—the minimum fixed in the act—while in 1911 the penalty was more than $100 in 46 cases and the maximum fine was in 3 cases $500, as compared with a maximum of $400 in only 1 case in 1910.

LIVE-STOCK QUARANTINE LAWS.

The statutes for the prevention of the spread of live-stock diseases have been vigorously enforced. One hundred apparent violations of these laws were reported to the Attorney General during the fiscal year 1911. Of these 90 were apparent violations of the act of March 3, 1905, and 10 were alleged violations of the act of May 29, 1884. In all penalties amounting to $5,580 were imposed in the 51 cases where a conviction was secured.

LACEY ACT.

During the year four cases arising under sections 242 and 243 of the Criminal Code of the United States, commonly known as the

Lacey Act, were reported to the Attorney General. The case against the 23 Japanese poachers who were arrested on Laysan Island in the act of killing birds was successfully prosecuted, the defendants being fined and imprisoned.

INSECTICIDE ACT.

The appropriation for the enforcement of the insecticide act did not become available until March, 1911. During the last four months of the fiscal year several formal and informal opinions on the construction of important sections of the statute were rendered, general guaranties filed under section 9 of the act were examined, and considerable correspondence was had with wholesalers, jobbers, and dealers.

PATENTS OBTAINED.

Nine applications for letters patent on inventions of employees of the department, for dedication to the public, were filed in 1910 and a like number in 1911. Of the pending cases 10 applications were allowed in 1911 as against 5 allowed and 1 disallowed in 1910. These inventions cover a wide range, including a plant-trimming machine, a process for wood impregnation, a camera support, a machine for testing the life of typewriter ribbons, devices for marking meats, and a method for constructing macadam roads.

OTHER WORK.

In addition to a compilation of references to the legislative history of acts of Congress enforced by the department, for use in construing any of the provisions of such statutes, and a revision of the Laws Applicable to the Department of Agriculture, embracing a compilation of existing statutes applicable to this department, the Solicitor prepared 442 notices of judgment for publication under the authority of section 4 of the food and drugs act, and prepared 20 circulars embodying decisions of the courts construing statutes intrusted to the department for execution. There is also in preparation a supplement to the annotated edition of the 28-hour law, bringing the original edition up to date.

The foregoing summary of the legal business transacted by the Office of the Solicitor scarcely conveys an adequate idea of the volume and character of the work actually performed. An examination of the reports of the various United States attorneys for the fiscal year 1911, made to the Attorney General, shows that the legal business of this department has increased in volume and importance to a very marked degree during that period. These reports, of course, make no mention of the legal business of the department which is finally disposed of by this office, not being ultimately referred to the United States attorneys.

WEATHER BUREAU.

The work of the Weather Bureau during the year has been carried on along accustomed lines. Its practical operations have consisted in the collection and dissemination of weather information and the issue of forecasts and warnings, and its remaining energies have been devoted to the study of meteorological problems yet unsolved. The routine work has been characterized by extension into new fields wherever opportunity was offered, mainly in the fruit-growing districts of the West, where spring frost warnings have been distributed under a more specialized system. The marine work has been enlarged to include meteorological charts for the Great Lakes and the Indian Ocean, which were formerly not represented in the series of ocean meteorological charts. Studies of conditions in the upper atmosphere, of solar radiation, and of the effect of climate on forests and stream flow constitute the special investigations conducted by the bureau during the year.

STUDIES OF THE UPPER ATMOSPHERE.

Kite flights at the Mount Weather Observatory and sounding-balloon campaigns at Huron, S. Dak., and Fort Omaha, Nebr., during the year completed four consecutive years of kite and balloon records. The results obtained during the year have been highly satisfactory. There were three distinct branches of this investigation: (1) Soundings of the upper air over Mount Weather, Va., by means of kites and captive balloons; (2) soundings of the air at great altitudes by means of free balloons carrying meteorological instruments; and (3) a study of temperature and pressure changes in the lower layers of the air at summit and base stations in the mountains of Colorado.

The exploration of the atmosphere by means of sounding balloons has become an international work. While a matter of general scientific interest, its importance to the Weather Bureau naturally hinges on the expectation that the facts disclosed may eventually be utilized in the improvement of weather forecasts. The discovery of conditions in the upper atmosphere altogether different from those formerly supposed to exist has been described in previous reports. The most important of these discoveries is the existence of a region in which a fall in temperature with increasing altitude ceases to take place. This stratum is encountered between 6 and 7 miles above the earth's surface and continues upward to an indefinite height. It is usually referred to as "the upper inversion." The most interesting facts regarding the upper inversion have to do with its variations in temperature and the movement of its winds.

Contrary to the order prevailing at the surface of the earth, the lowest temperatures of the upper inversion are found in equatorial regions and the highest in the middle latitudes. Furthermore, its temperature, while practically constant from season to season, varies greatly from place to place and from day to day. European investigations seem to show that the beginning of the upper inversion is found at a lower altitude over cyclonic than over anticyclonic areas, and that it is higher in summer than in winter. Observations in this country coincide with those in Europe as to the winter and summer heights, but are inconclusive respecting the supposed relation of its altitude to areas of differing atmospheric pressure.

Sounding balloon ascensions have added much to our knowledge of the temperature of the atmosphere up to heights of 9 miles, and even higher, but the number of ascensions above that altitude is yet small. The lowest temperature recorded in any of the Weather Bureau's series of observations is —92° F. at Huron, S. Dak., in September, 1910. The vertical distribution of temperature in different sections of cyclones and anticyclones presents at times unusual features, the importance of which will be realized when it is remembered that forecasts of temperature changes are at present based entirely upon prevailing surface temperatures without taking into account the possible modifying effects that unusual temperature conditions above may introduce later.

Equally interesting are the facts regarding wind direction and velocity in the upper atmosphere. Observations show that while the lower limit of the upper inversion is not sharply defined, the air motion in the explored part of that region partakes of and is to some extent controlled by that of the lower atmosphere on which it rests. At the same time it also appears that the gyratory motion of the air characteristic of cyclones at the earth's surface and for some distance above does not extend far upward. The general conclusions as to the winds in the upper inversion in their relation to those of the lower layers are that the air currents are from some northerly direction on the east side of anticyclones and from some southerly direction on the west side, and that under practically all other conditions the drift of the air at very high levels is from west to east.

The observations taken at mountain stations in Colorado show that variations in temperature at the summit and base stations are nearly coincident in point of time and that they are generally similarly directed, but that a fall in temperature occasionally sets in on the plains while the temperature on the mountain tops is still rising. At other times the weather conditions on the mountain summits have been controlled by causes that are not operative on the plains to the eastward. These studies have increased our knowledge of the effect of local topography in the warming and cooling of the air that is trapped between the mountain ranges.

SOLAR RADIATION.

Studies in solar radiation have been continued at Washington and at Mount Weather, and were begun at Madison, Wis., during the year. Arrangements are now being made for additional pyrheliometric observations at various points in the region west of the Great Lakes and the Mississippi River. The most striking features of the record for the year were the high value of the radiation in February and March on the front of marked high barometric areas and the low value during the protracted hot wave in May.

It is believed that the determination of the intensity of direct solar radiation, of the quantity of heat received diffusely from the whole sky, and of the rate at which heat is lost at night, will not only be of value to climatologists generally, but will also be utilized by the weather forecaster. A demand has already been made by biologists for accurate data of this nature.

FORECASTS AND WARNINGS.

During the hurricane season of 1910, only two tropical storms of note visited the United States. That of September, 1910, moved from near San Juan, P. R., on the 6th to the Texas coast near the mouth of the Rio Grande on the 14th. Warnings were issued regularly until the storm disappeared. There was no loss of life nor was much damage done, except on the north coast east of San Juan. The hurricane of October was more severe, yet the damage was reduced to the minimum by timely warnings.

Plans are now under consideration for the systematic extension of the field of meteorological observation by means of cooperation between the Weather Bureau and the steamship lines equipped with wireless plying in Atlantic and southern waters, through which it is hoped to be able to locate hurricanes and other severe storms immediately following their inception.

Forecasts of the general character of the weather for a week in advance were issued weekly during the year. These, in the main, have proved reasonably accurate. The weekly forecast issued on August 21, 1910, announcing that a cool wave would pass over the country the latter part of the ensuing week, attracted special attention, and its complete verification called forth widespread and favorable comment.

These comparatively long-range forecasts are based on a study of the atmospheric conditions exhibited on the daily chart of weather observations for the Northern Hemisphere.

Special attention has been given to frost warnings in the spring, principally in the cranberry marshes of Massachusetts, in the citrus-fruit districts of Florida, and in a number of the orchard sections of Washington, Oregon, Idaho, Utah, Colorado, and California. The plan of operations involves the closest cooperation possible between the Weather Bureau and the growers, through which the latter may be advised specifically as to the probable critical temperature and be in readiness to light smudge fires or adopt other protective measures on short notice.

By informal agreement with the Interior Department, the Weather Bureau was designated to ascertain and publish in the Monthly Weather Review the losses by floods in the United States. A summary of this character indicates that the losses during the year were about $7,700,000, of which more than three-fourths fell upon the farmers. The value of property saved through the warnings of the Weather Bureau was estimated at $1,047,000. The great disproportion between the losses and the value of property saved is due to the fact that three-fourths of the former were on crops that warnings could not have saved.

BUREAU OF ANIMAL INDUSTRY.

The main lines of work carried on by the Bureau of Animal Industry are as follows: (1) Inspection of animals, meat, and meat food products intended for interstate movement or for export, and of the vessels carrying export live stock; (2) inspection and quarantine of imported animals; (3) control and eradication of contagious and infectious diseases of animals; (4) scientific investigation of such diseases; (5) investigations in the breeding and feeding of live stock and poultry; (6) work relating to the dairy industry; and (7) preparation of literature and diffusion of information on these subjects.

THE MEAT INSPECTION.

The meat inspection comprises the inspection of animals before and after slaughter, the supervision of all the processes of preparing meats and meat food products, the enforcement of sanitation and correct labeling, and the exclusion of harmful preservatives and coloring matters. It is carried on at slaughtering and packing establishments engaged in interstate or export trade.

The work continues to show an increase. Inspection was conducted during the fiscal year at 936 establishments located in 255 cities and towns. There were inspected at slaughter 52,976,948 animals, consisting of 7,781,030 cattle, 2,219,908 calves, 29,916,363 hogs, 13,005,502 sheep, and 54,145 goats. There were condemned for disease or other unwholesome condition 117,383 entire carcasses and 1,009,672 parts of carcasses, making a combined total of 1,127,055 carcasses and parts that were condemned. The condemnations were as follows:

Cattle, 39,402 carcasses, 123,969 parts; calves, 7,654 carcasses, 781 parts; hogs, 59,477 carcasses, 877,528 parts; sheep, 10,789 carcasses, 7,394 parts; goats, 61 carcasses. Tuberculosis was the cause of nearly 47 per cent of the condemnations of adult cattle and over 96 per cent of the condemnations of hogs. The inspected animals furnished fully 10,000,000,000 pounds of meat. There was condemned on reinspection 21,073,577 pounds of meat and meat food products that had become sour, tainted, or otherwise unfit for food since the inspection at the time of slaughter. This amount included over 3,000,000 pounds condemned at one establishment as the result of a fire.

Inspection certificates issued for exports of meat and meat food products during the year covered 975,066,006 pounds, including all products, fresh and preserved. This was an increase of over 150,000,000 pounds compared with 1910. Inspections for the Navy during 1911 aggregated 11,112,060 pounds.

During the year 25,818 samples of various products were examined in the meat inspection laboratories for the purpose of detecting prohibited preservatives or coloring matter, adulterants, and unwholesomeness of various kinds, and passing upon the purity of condiments, water supplies, etc. The use of prohibited preservatives and coloring matters at inspected establishments appears to be exceedingly rare, and in the very few cases in which such preservatives were found their presence was evidently due to ignorance or carelessness. The most frequent violations of the regulations consisted in the use of cereal substances in sausages without proper declaration on the labels.

HORSE BREEDING.

Good progress is being made in the breeding of carriage horses in Colorado in cooperation with the State Agricultural Experiment Station. At the close of the fiscal year 1911 the stud consisted of 82 animals (34 males and 48 females). The males comprised 11 stallions two years old and upwards, 11 yearlings, and 12 weanlings, while the females included 25 aged mares, 5 four-year-olds, 3 three-year-olds, 4 two-year-olds, and 11 yearlings and weanlings. The annual culling of inferior individuals is showing its results, and the foals show better quality each year. During the year the board of survey condemned 8 animals, which were sold at auction.

The breeding of Morgan horses on the Government farm at Middlebury, Vt., continues with promising results. There were 65 head in this stud at the close of the year, namely, 17 stallions, 42 mares, and 6 geldings. Five out of a lot of 10 mares purchased last year were bred in Vermont, and are good representatives of the old-fashioned Morgan lines which have proved so valuable in mating with General Gates, the stallion at the head of the stud. The five-year-old stallion Red Oak has been leased to the Massachusetts Agricultural College for the purpose of breeding to mares which fulfill certain prescribed conditions.

An experiment in breeding gray draft horses is in progress in Iowa, in cooperation with the Iowa Experiment Station. Four out of five foals dropped during 1911 are living. Two of these are by a Shire stallion out of Clydesdale mares, and two by a Clydesdale stallion out of Shire mares. All the mares are worked on the farm.

Although the desired appropriation for the encouragement of the breeding of horses for the United States Army was not provided by Congress, a small beginning was made in cooperation with the War Department, the slight expense on the part of the Department of Agriculture being paid from the appropriation for animal breeding and feeding experiments. Two Thoroughbred stallions were presented to the War Department by Mr. August Belmont, and these have been turned over to this department for use in accordance with a cooperative plan. The stallions are being stood for public service at the remount station of the Army at Front Royal, Va., under the direction of the Bureau of Animal Industry, and have been bred to about 50 mares. Only approved mares are bred to these stallions, and each mare owner agrees to give the Government an option on the resulting foal at three years at $150. It is hoped that Congress will provide funds for the extension of horse breeding for the Army, as it is evident that the Government must do something to encourage the breeding of horses of the proper types if the Army of the future is to be supplied with an adequate number of suitable remounts.

SHEEP AND GOATS.

Satisfactory progress has been made in the breeding of range sheep in Wyoming. The ewes gave an 80 per cent crop of lambs last spring, and those ewes which are to continue in the experiment sheared 13.1 pounds per head.

Southdown sheep are being bred at the Morgan horse farm in Vermont, and Barbados sheep at the experiment farm of the Bureau of Animal Industry at Beltsville, Md. Native goats are being bred at the bureau farm for milk production, and in addition some representatives of the Saanen breed have recently been acquired.

CATTLE BREEDING.

The breeding of milking Shorthorn cattle in cooperation with the Minnesota Experiment Station has made satisfactory advance during the year, four herds having been added to the circuit. The operations last year were mostly confined to the general improvement of the herds. Better care and management have resulted in improved milk and butter-fat production and in better development of the young animals.

The Holstein breeding circuit in North Dakota, in cooperation with the State Experiment Station, has been conducted on the same lines as heretofore. A year's record of all the cows was completed January 1, and the approximate cost of the production of butter fat determined. As a result several heifers have been placed in the Advanced Registry. There are now 107 pure-bred Holstein cattle owned by members of this circuit.

POULTRY AND EGG INVESTIGATIONS.

Poultry breeding for egg production and for general utility purposes is going on in Maine (in cooperation with the Maine Experiment Station) and at the bureau's experiment farm in Maryland. A plan of selection is being practiced so as to secure strains which breed true to certain definite standards of egg production.

An investigation is being conducted into the conditions surrounding the handling and marketing of eggs in the great productive sections of the Middle West, especially in Kansas, with a view to determining the causes of the heavy losses from deterioration and to preventing such losses. This work, in which State authorities are cooperating, is expected to bring about great improvement in the quality of the eggs marketed, to the advantage of both producer and consumer. Some results of this work have been published as Bulletin 141 of the Bureau of Animal Industry, "The improvement of the Farm Egg."

ANIMAL NUTRITION.

Animal nutrition investigations in cooperation with the Pennsylvania State College have been in progress for a number of years. The work is of a scientific character, much of it being done with the respiration calorimeter. The determinations of the energy values of feeding stuffs are to be continued, and it is planned to make further respiration tests.

BEEF AND PORK PRODUCTION IN THE SOUTH.

The beef-feeding experiments in cooperation with the Alabama Experiment Station are yielding results of much value to southern farmers. The work so far accomplished demonstrates that cattle can be profitably fed in Alabama in summer. Pork-feeding investigations, also in Alabama, are likewise showing profitable results. There is no doubt that the South affords a favorable field for increasing the country's meat supply, especially after the handicap of the cattle tick has been removed.

CERTIFYING PURE-BRED IMPORTED ANIMALS.

Since January 1, 1911, the Bureau of Animal Industry has undertaken the duty of certifying to the pure breeding of all animals imported for breeding purposes, the work being done by arrangement with the Treasury Department and in accordance with the tariff law. During the first six months 1,172 horses, 1,427 cattle, 12 sheep, 7 hogs, 190 dogs, and 12 cats were thus imported.

DAIRY FARMING.

Work for the development and improvement of dairying is being carried on in the South and West, and includes improved breeding, economical feeding, encouraging the building of barns, silos, etc., the stimulation of interest in dairy organizations, the improvement of city milk supplies, the operation of model dairies, the supervision of exhibits and contests at fairs, helping farmers to improve the grade of cream furnished to creameries, etc. The southern work is in progress in nine States, and the western work is being conducted in Iowa, North Dakota, Colorado, and Idaho. The reduction of the range and the increased price of land have a considerable effect on dairying in this latter region, and helpful work is being done in demonstrating new and economical methods.

Dairy farmers are encouraged to keep records showing the amount of feed consumed and milk and butter fat produced by each cow, so that unprofitable animals can be weeded out and the herd built up with good producers. The utility of keeping such records was illustrated in several instances during the year. In one herd the work resulted in the sale of 25 unprofitable cows and in another the cost of feeding was reduced from $6.05 to $4.63 per cow per month.

There are at present 81 cow-testing associations in the United States, comprising owners of about 40,000 cows. The department was instrumental in organizing the greater number of these, and often lends assistance when difficulties arise.

The demand for plans for the construction of dairy buildings continues heavy, and during the year blue prints were sent out for 636 buildings.

MARKET MILK INVESTIGATIONS.

The bureau has continued its work for the improvement of market milk. This consists chiefly in introducing and maintaining the score-card system of dairy inspection, in assisting at competitive exhibitions of milk and cream, and in investigating the conditions surrounding the milk supply in various places. This work is carried on largely in cooperation with city health departments, and was conducted during the fiscal year in 51 cities in 27 States. The extension of the score-card system of inspection is producing good results. During the year 620 inspections were made in 24 States, these inspections always being made in company with the local health officer or one of his assistants. Nine competitive milk and cream contests were participated in by the bureau. The milk supply of several of the Government departments is being supervised, and a special investigation of the milk supply in the vicinity of Boston, Mass., has been under way for several months.

DAIRY MANUFACTURES.

Assistance has been rendered to creameries as heretofore by furnishing information and advice regarding creamery operations. Periodical reports are received from about 1,300 creameries in various parts of the country, and these enable the bureau to point out defects in operation, so that losses may be overcome, the quality of the product improved, by-products utilized economically, and waste avoided. Field men are located in Wisconsin, Minnesota, Iowa, California, and Texas, and personal attention is given to such cases as seem to require it. During the year 74 creameries were visited by these men.

The market inspection of butter indicates that a large quantity of low-grade butter is still being manufactured. Of 2,161 shipments inspected from creameries in Minnesota, Wisconsin, and Iowa, only 277, or 13 per cent, graded "extra." The department endeavors to point out how improvement can be effected.

The department also aids in the organization of new creameries by furnishing articles of agreement, lists of machinery, etc., but care is exercised to give this assistance only in those localities where creameries are likely to succeed.

An investigation into the most practicable method of harvesting and storing natural ice was undertaken because a large number of dairymen who might avail themselves of such ice at little cost at present do not use any at all. The lack of ice is responsible for a large amount of bad cream received at creameries, as well as for much of the inferior milk delivered in cities.

The manufacture of renovated butter was supervised during the year, in accordance with law, at 38 factories in 13 States. The total quantity produced was 41,115,058 pounds, of which 118,990 pounds was exported.

DAIRY RESEARCH LABORATORIES.

The dairy research laboratories were engaged during the year upon various technical problems connected with milk, butter, and cheese. Work on milk and butter is carried on at the central laboratory in Washington and the field laboratory at Troy, Pa. Chemical and bacteriological work on the Swiss type of cheese is done at Washington, the cheese being made at the Pennsylvania State College in cooperation with that institution. Experiments in the manufacture of the Cheddar type of cheese are carried on at Madison, Wis., in cooperation with the Agricultural Experiment Station of the University of Wisconsin. Work on the Roquefort type of cheese is conducted at Storrs, Conn., in cooperation with the Storrs Agricultural Experiment Station. Investigations on milk secretion are carried on at Columbia, Mo., in cooperation with the experiment station of the University of Missouri.

The work with milk during the year consisted mostly of a study of the bacteria of pasteurized and raw milk. In addition about 150 analyses of goat's milk were made, and the use of buttermilk and whey as by-products received attention.

Investigations were carried on pertaining to changes in storage butter, and experiments were made with a view to producing dried cultures for use in butter and cheese making. The results of the Roquefort cheese investigations for assisting the manufacture in this country of that well-known European variety of soft cheese will soon be ready for publication.

Some important results have been secured in the milk-secretion experiments, wherein certain cows were fed rations varying from below maintenance to fattening. These results will be published in due course. Work has also been done concerning the effect on the milk when cows are fed with cottonseed products.

THE STUDY AND CONTROL OF ANIMAL DISEASES.

Some of the animal diseases which have been the subject of investigation and eradication during the fiscal year are Texas fever, tuberculosis, glanders, hog cholera, rabies, dourine of horses, scabies in sheep, cattle, and horses, lip-and-leg ulceration of sheep, ringworm of sheep, roundworms and tapeworms of sheep, gid in sheep, necrobacillosis of various animals, chronic bacterial dysentery of cattle, swamp fever of horses, and poultry diseases. A few facts concerning the more important of these will be mentioned.

TEXAS FEVER AND TICK ERADICATION.

The eradication of the ticks which transmit the contagion of Texas fever of cattle and which inhabit the southern part of the country is proceeding vigorously in cooperation with State and local authorities. During the fiscal year the territory released from quarantine as a result of this work aggregated 10,965 square miles. Since the beginning of systematic work in exterminating these ticks five years ago there have been cleared of ticks and released from quarantine

139,821 square miles. This is about one-fifth of the original infested area.

Dipping experiments have been continued with a view to finding the most effective and economical means of ridding cattle and pastures of the ticks. Recent work shows that arsenic yields better results than the crude petroleum formerly used as a dip. Arsenical dips are therefore now being principally used.

During the year 4,016,048 inspections of southern cattle were made by employees of the Bureau of Animal Industry in connection with the work of tick eradication. The number of cattle permitted unrestricted movement under certificate was 103,338, and of these 45,613 were dipped or otherwise treated.

The movement of cattle from the quarantined area is carefully regulated so that the disease can not be transmitted to animals outside the area. There were shipped from the quarantined area to northern markets during the quarantine season of 1910, under the supervision and in accordance with the regulations of the department, 1,065,119 cattle.

SCABIES OF SHEEP AND CATTLE.

In the work for the eradication of the parasitic diseases known as scabies in sheep and cattle, employees of the Bureau of Animal Industry made 56,584,129 inspections of sheep and 18,593,251 inspections of cattle, and supervised 12,715,631 dippings of sheep and 1,234,123 dippings of cattle. There were released from the quarantine for scabies of sheep 22,560 square miles in Oregon, and from the quarantine for scabies of cattle 14,810 square miles in South Dakota, Nebraska, and Kansas.

TUBERCULOSIS.

Tuberculosis has been for many years a subject of investigation by the Bureau of Animal Industry. During the year the problem of protecting animals from the disease by vaccination has been studied at the Bureau Experiment Station. Some favorable results have been obtained, but, as the only methods found effective require the use of living tubercle bacilli, such methods are not considered practicable for general use because of the danger of spreading the disease.

Some important results were obtained during the year in the pathological laboratory through a study of material from hogs fed upon garbage from the kitchen of an institution where tuberculous insane were kept. Both the human and bovine types of tubercle bacilli were obtained from these hogs. Further tests were also made in the laboratory with the ophthalmic and intradermal methods of applying the tuberculin test for the diagnosis of the disease.

The work of eradicating bovine tuberculosis in the District of Columbia as reported last year has been followed by the systematic retesting of cattle with tuberculin to guard against the reappearance or reintroduction of the disease. The testing of dairy herds in Maryland and Virginia which supply milk to the city of Washington has also been continued. During the fiscal year the tuberculin test was applied to 4,327 cattle in Virginia, 1,847 in Maryland, and 1,967 in the District of Columbia. The percentage of diseased cattle among those not previously tested was 16.06, while in the retests it was only 3.95. Seventy-three reacting animals in the District of Columbia were slaughtered, and in all but one case the lesions of tuberculosis were found on post-mortem examination, thus verifying the result of the tuberculin test.

INSPECTION OF LIVE STOCK FOR INTERSTATE MOVEMENT.

In addition to work already reported, the bureau inspects live stock for interstate movement for purposes other than immediate slaughter, and tests cattle with tuberculin and horses and mules with mallein, when such measures are required by the laws of the State or Territory to which the animals are destined. In this work 52,230 cattle were inspected during the year, of which 18,778 were tested with tuberculin. Similarly 34,789 horses and mules were inspected and 5,789 tested with mallein.

DOURINE OF HORSES.

An outbreak of a disease of horses in Iowa, suspected of being dourine, was reported in May, and a prompt investigation was made, as a result of which the scientists of the Bureau of Animal Industry were able by prolonged search with the microscope to find in the blood the causative organism of the disease. This was the first time that the organism had been demonstrated in a natural infection in the United States, although the disease had existed in this country for some years and had been stamped out about five years ago. The manner in which the present outbreak was introduced was not positively determined, although indications pointed strongly to its having been brought in by an imported stallion. Strict quarantine measures were at once enforced, with the cooperation of the Iowa State authorities, and the disease is now believed to be practically eradicated.

HOG CHOLERA.

The practical value of the serum for the prevention of hog cholera, produced after long experimentation by the Bureau of Animal Industry, is now generally recognized. At the suggestion of the department, the large hog-raising States have taken up the manufacture and distribution of the serum, and upward of 200,000 inoculations have already been made by State officials in 21 different States. The results of this work have been extremely favorable.

At the request of Nebraska State officials and the Nebraska Swine Breeders' Association the bureau carried out a demonstration with the preventive serum at South Omaha during the year, similar to a previous test held at Kansas City. Thirty young hogs were used, of which 4 were inoculated with blood from hogs sick of hog cholera, 18 were given one dose of the serum, and the remaining 8 were left untreated. All the hogs were then placed together in one pen, the experiment extending from July 23 to September 17. The result was that the 4 inoculated hogs as well as the 8 untreated hogs died of hog cholera, while the 18 hogs that had been given the serum all remained perfectly well.

RABIES.

During the fiscal year the brain tissues from 173 suspected cases of rabies were examined in the pathological laboratory at Washington, including 152 dogs, 8 cattle, 2 hogs, 1 horse, and 1 goat. The great majority of these cases came from the District of Columbia and the surrounding country. One hundred and thirty proved to be positive, the method of diagnosis being the detection of Negri bodies, supplemented in some instances by the inoculation of rabbits.

EXPORT AND IMPORT ANIMALS.

During the fiscal year there were made 370,369 inspections of American and 32,470 inspections of Canadian animals for export. The number of animals actually exported was 171,006; the greater number of inspections is accounted for by the fact that many of the animals were inspected two or more times. This work also includes the supervision of vessels, of which 438 inspections were made.

All live stock for export to Canada are inspected by bureau veterinarians, and cattle, horses, and mules must in addition be tested—the cattle with tuberculin and the horses and mules with mallein. During the year 13,404 horses, 1,046 mules, and 460 cattle were thus tested, the reactions numbering 251 horses, 12 mules, and 16 cattle. The other inspections for Canada were 28,428 sheep, 25 goats, and 110 swine.

A strict inspection, with quarantine in certain cases, is maintained over all animals imported from foreign countries. This is necessary in order to exclude the numerous animal diseases which are prevalent in other parts of the world. For this purpose hay, hides, wool, etc., are also inspected and disinfection required. The total number of import animals inspected during the year was 261,478, and of these 4,127 were quarantined in accordance with the regulations.

DISTRIBUTION OF VACCINE, ETC.

Over 1,000,000 doses of blackleg vaccine were prepared and sent out during the year by the Bureau of Animal Industry. The necessity for immunization against this virulent disease of young cattle is being more thoroughly appreciated by cattle raisers, and the department vaccine is the means of preventing heavy losses.

Tuberculin and mallein are furnished to State, county, and municipal officials for the diagnosis of tuberculosis and glanders, respectively. During the past year 422,043 doses of tuberculin and 91,642 doses of mallein were sent out.

The department does not distribute the preventive serum for hog cholera, this work having been taken up by State laboratories, as already mentioned.

NEEDED LEGISLATION RELATING TO ANIMAL INDUSTRY.

Further legislation by Congress is urgently needed in order to enable the department to deal more effectively with matters relating to the live-stock industry.

It is especially desirable that the Secretary of Agriculture should have power to control and supervise the manufacture and importation of vaccines, serums, and like substances used for treatment of animals, so as to insure their purity and potency. Such preparations, when contaminated, have in the past been responsible for the introduction of contagious diseases into the country. The great cost of eradicating these outbreaks should alone be a sufficient reason for granting the authority required.

Further legislation is also needed for the regulation of live stock in interstate transportation, so as to prevent more effectively the spread of contagious disease and to secure more humane treatment of the animals in transit.

These matters are discussed more fully and specifically in my report for 1910 and in the report of the Chief of the Bureau of Animal Industry for the fiscal year 1911.

BUREAU OF PLANT INDUSTRY.

There are over 6,300,000 farms in the United States, and the demand for help from these farms is growing greater each year. The Bureau of Plant Industry is endeavoring to meet some of these demands, and its activities now extend into many fields, covering research, experiments, and demonstrations. The primary function of the bureau is to develop and encourage constructive agriculture by assisting the farmer to increase the output per acre and at the same time to build up and maintain the fertility of the land. The manner in which this is being done and some of the more important results accomplished during the year are set forth under the following heads:

FOREST PATHOLOGY.

The continued spread of the chestnut-bark disease, particularly southward and westward, has caused great public alarm. The method of destroying advance infections devised by this department and described in previous publications has been energetically applied in Pennsylvania, and recently also in New York. There is every reason to believe that the disease in these two States can be limited to the eastern counties. The State appropriation for this work in Pennsylvania is $275,000. In the New England States it will probably still be possible to keep the disease to the west of the Connecticut River; but this is essentially a local issue, with little bearing on the welfare of other States. What is done in western Maryland, in Virginia, and in West Virginia, however, is a matter of national importance, for the fate of the chestnut in the southern Appalachians, where the finest and most extensive stands of chestnut timber occur, depends upon the checking of the bark disease in these States during the next three years. This department can cooperate to any extent in the study of all phases of the disease and in the location of advance infections, but the actual destruction of diseased trees must, for legal reasons, be exclusively a State function. It is therefore to be hoped that these critical States will be able promptly to follow the vigorous example of Pennsylvania. No other tree disease of equal seriousness is known to science, and unless prompt, united, and effective action can be taken there is every reason to believe that the chestnut tree will be practically extinct in certain sections of North America within 10 years.

On account of their important relation to reforestation, damping-off and other diseases of forest-tree seedlings have received special attention. The results of the past season's work have confirmed the previous report of absolute success in controlling the serious "blight" of coniferous seedlings by slight and perfectly practicable changes in the management of water supply and shade. For two seasons past the use of sulphuric acid in preventing the damping-off of coniferous seedlings in the Forest Service nursery at Halsey, Nebr., has been successful. If these results are confirmed by work in other localities and other years, damping-off, so far as coniferous seedlings are concerned, will cease to be an uncontrollable factor in reforestation. The use of sulphuric acid as a soil fungicide originated in this department, as reported in previous publications.

It is unfortunate that at this time, when interest in reforestation is at its height, we should knowingly import a destructive European nursery disease. Yet this appears to be the case. The white-pine blister rust, referred to in previous reports, is unquestionably still being imported. All importations that could be located have been inspected and all visibly diseased trees destroyed, but there are no means of locating all importations. The importation of white-pine seedlings should be flatly prohibited, as the damage which this disease can do, and probably will do, if once established in America, is out of all proportion to the value of all white-pine seedlings ever imported or ever likely to be.

Data collected in the forest-disease survey have indicated that in America timber decay and tree disease are second only to forest fires as causes of loss. In theory it is easy to remove diseased trees in the forest when cuttings are made, leaving only healthy individuals for seed trees, and so continually improve the health of the forest; but in practice so many questions of economy and differing local conditions are involved that many difficulties must be overcome. The Bureau of Plant Industry has given a great deal of attention to working out this problem, in active cooperation with the Forest Service. To this end, pathologists have been stationed in four of the six National Forest Districts. In District 5 great progress has been made in so conducting timber sales that all dangerously diseased trees are removed and only healthy and desirable individuals are left to propagate the future forest. Probably the most important function of these "district pathologists" is to look out for dangerous new diseases. There is every reason to believe that if the chestnut-bark disease, for example, had started in a National Forest District having a pathologist it would have been eradicated as a matter of routine before infection became general. Great epidemics of this kind are as serious in their effects as forest fires, and there is no reason why as strenuous efforts should not be made to control them.

CROWN-GALL AND OTHER PLANT DISEASES.

An important line of work carried on during the past year has been a continuation of the study of crown-gall of plants, with special reference to its relation to malignant animal tumors. The new facts we have learned are, in brief: (1) That bacteria occur also in the secondary tumors; (2) that in most cases the secondary tumors are connected with the primary tumor by a deep-seated strand of tumor tissue, from which the original bacterium has been cultivated out; (3) that the cell structure of the secondary tumor is like that of the primary tumor, e. g., when the primary tumor occurs on the stem and secondary tumors subsequently appear in the leaves the structure of the leaf tumors is that of the stem. A bulletin is in preparation which will fully illustrate these new features.

The work in the bud-rot of the coconut palm has been completed, the very interesting discovery having been made that the organism associated with typhoid fever and not hitherto known to be a plant parasite is the cause of the bud-rot disease. A bulletin on the subject is now in press.

DISEASES OF FRUITS.

A feature of the fruit-disease problems of the year has been the prevalence of physiological diseases, particularly of the apple. In the Eastern States physiological troubles have occurred in the form of corky spots in the flesh of apples, accompanied by more or less distortion in the shape of the fruit. The York Imperial, the Ben Davis, and other commercial varieties have been affected so seriously as to injure the sale of fruit from orchards. These troubles are attributed mainly to the abnormal climatic conditions of the 1911 season.

A group of diseases, such as rosette and chlorosis, has developed in eastern orchards so as to attract attention, and they have increased greatly in the Western States. The extreme climatic conditions of the season have resulted in more injury by the new combination sprays of lime-sulphur and lead arsenate, but nevertheless these sprays are proving to be the most universally satisfactory remedies that have ever been devised.

Very satisfactory results have come from the researches on apple mildew and its treatment. Experiments on this disease in the Watsonville district of California, in cooperation with the local authorities, have developed a satisfactory method of control by spraying.

The cedar rust, or orange rust, of the apple, which was so common in the Appalachian fruit belt last season, was very much less abundant during 1911. Most of this was the result of climatic conditions, though the application of control measures, such as cutting down the cedars and spraying, helped to reduce the disease.

Spraying experiments on the pecan scab were continued for the third season, and Bordeaux mixture was demonstrated to be a specific for pecan scab in Georgia. The pecan rust on nursery stock was studied and complete success obtained in controlling it by spraying.

Peach spraying work for the control of peach scab and brown rot was conducted in West Virginia, Delaware, and Michigan. A portion of the work was experimental, for the purpose of testing new fungicides and perfecting the self-boiled lime-sulphur treatment, but most of the work was in the nature of demonstrations. The results were very striking, and showed conclusively that where one or both of these diseases are prevalent the net profits from a peach crop may be doubled, or in some cases quadrupled, by spraying at the proper time.

Apple spraying experiments and demonstrations were conducted in several widely separated districts, and it was again shown that lime-sulphur properly diluted is a more satisfactory fungicide for certain apple diseases than Bordeaux mixture. However, owing to the severe weather conditions of the season, the combination of lime-sulphur and arsenate of lead caused considerable burning of the fruit in a few orchards, but this trouble was not so serious as to discourage the use of this spray.

The grape anthracnose is very destructive to both fruit and vine. Certain varieties in some localities are attacked every year by this disease. The department has demonstrated the past season that this malady can be satisfactorily controlled by proper spraying of the vines while in a dormant condition. Further confirmation of previous results in the control of black-rot of the grape has also been obtained. Very promising results have been secured in controlling the anthracnose of the cranberry, which has been found to be a prevalent cause of loss in some cranberry districts. Considerable progress has also been made in the study and control of other small-fruit diseases.

DISEASES OF COTTON AND TRUCK CROPS.

Diseases of the potato have assumed unusual prominence throughout the country during the past season. Physiological disturbances have combined with several parasitic diseases in bringing about a general reduction of the crop. Blackleg and both the early and late blights have been sufficiently severe to emphasize the importance of a more general adoption of preventive treatment by growers, but by far the most serious damage has been caused by potato wilt, a disease which usually assumes an inconspicuous form, causing premature ripening followed by dry-rot in storage. The unusually dry season, which retarded the early growth of the plants, was very favorable for the development of wilt. The resulting epidemic has served to emphasize the wide distribution of this disease and has given it a new importance. Studies are under way which should lead to a more thorough knowledge of the causes and the means of control.

Investigations on the diseases of sweet potatoes have been inaugurated and substantial progress made. The causes of the more important troubles are now known, some of them for the first time, and means of control are being studied with encouraging results.

The disease-resistant varieties of cotton, cowpea, and watermelon which the department has developed are being brought into more general trial by thoroughly organized cooperative arrangements with growers in the infested sections. This organization is being extended as rapidly as the nature of the problem and the facilities of the department will permit.

Cooperative demonstration work on the control of truck-crop diseases by proper spraying methods is a new form of work inaugurated to bring the latest results along these lines to the attention of growers. An important feature of this work is the development of special machinery and technique to meet the demands of the varying conditions of culture and climate in different sections.

PATHOLOGICAL INSPECTION WORK.

The necessity of pathological inspection of all foreign importations has long been recognized, and in the early years the mycologist was called upon at irregular intervals, i. e., whenever importations were received by the department, to make examinations. As the Office of Foreign Seed and Plant Introduction developed and extended its geographical range, inspection of the department's plant imports has been definitely systematized by means of regular examinations, and printed health certificates or written reports for treatment or quarantine are furnished as occasion requires. The same methods are followed in connection with the congressional seed distribution, crop physiology and breeding investigations, and the Office of Gardens and Grounds. Card indexes are maintained for a complete file of observations and results. Advance information is furnished agricultural explorers, that they may be aware of diseases indigenous to certain countries or geographically restricted, thus enabling them to avoid unnecessary expense in making collections which would have to be condemned at Washington.

NEED FOR TRAINED PLANT PATHOLOGISTS.

The growing need for trained plant pathologists to take up numerous problems which are now being presented to this department for solution is extremely urgent. While the universities and colleges appear to be doing what they can, it happens usually in our work that men fresh from college do not have the requisite outlook or the necessary training to obtain practical results in this field. Usually we have to give them several years of additional training in order to make them most serviceable to the advancement of agriculture in these lines. Every year requests come to us from the experiment stations and similar institutions in the United States to name persons well qualified for appointment to positions involving plant pathological research in these various institutions, and, unfortunately, in a very considerable number of cases we have to say that, glad as we would be to recommend persons, there are none in sight with the necessary training. This lack of a sufficient number of trained pathologists works to the serious disadvantage of agriculture in this country. The department would be glad to have in training an additional number of young men for such positions.

COTTON IMPROVEMENT ON A COMMUNITY BASIS.

To secure the full advantage from improved varieties of cotton it is essential that each locality growing the improved variety produce a sufficient quantity to warrant its reaching the manufacturers unmixed with other varieties. In a community that planted only one kind of cotton, the crossing of varieties in adjacent fields and the mixing of seed in gins would be avoided, selection could be made much more effective, and the production of a larger quantity of uniform fiber would secure higher prices. In view of these and other obvious advantages, special attention has been given to establishing improved varieties and methods of selection in communities organized for the production of a single type of cotton.

LONG-STAPLE COTTON IN THE ATLANTIC STATES.

The advance of the boll weevil has reduced the production of long-staple Upland cotton in Mississippi and Louisiana, resulting in an acute commercial demand for this type of fiber. The action of State quarantine laws against the importation of cotton from sections infested with the cotton boll weevil and the high prices realized by eastern growers of the Columbia variety originated by this department have stimulated interest in this variety to the extent that all the available supplies of good seed were long ago exhausted. Special efforts are being made to preserve the uniformity of this variety by growing new supplies of seed under conditions of isolation from other cotton and by more effective cooperation in the work of selection.

SUGAR-BEET INVESTIGATIONS.

The sugar beet has established itself as one of the most important agricultural crops over a large section of the country, but in the transplanting of this European industry to the virgin soil of America many new problems have arisen. A system of well-equipped field laboratories in the beet-growing regions, where studies in pathology, breeding, and agronomy can be carried out in close contact with the fields, is essential to a speedy and successful solution of the various problems presented. Two such additional laboratories have been established during the past year, and others are contemplated for the near future.

Leaf-spot and curly-top, two important diseases of sugar beets, have received special attention, and work upon damping-off and root-rot has been inaugurated.

The breeding of special strains of beets for American conditions is an important line of work which should yield valuable results. It has already been shown that American-grown seed yields beets which are superior to those grown from European seed. Moreover, the seed produced by Europe is insufficient to meet the increased demands of both the European and the American markets. Indeed, Old World dealers have recently turned to America in an attempt to purchase large quantities of American-grown sugar-beet seed for sale in Europe. It appears that America must produce her own beet seed before the beet-sugar industry can become properly established here. It is only natural that in the face of the present shortage the best of the European seed should be retained for use there, so that the American sugar-beet growers are not only sending many hundreds of thousands of dollars annually to Europe for seed which should be produced at home, but they run grave risks of securing only inferior seed which will materially reduce the profits of beet growing.

A number of problems in beet culture and questions of irrigation and rotation are also pressing for solution. Work along these lines has been inaugurated and is being pushed with all possible dispatch. In order to profit as fully as possible by the knowledge gained by Europeans in their long experience with this crop, a representative of the department has been sent to visit the beet fields and experiment stations of Germany, France, and Russia, with a view to the adapting of their practices to American conditions.

SOIL-BACTERIOLOGY AND WATER-PURIFICATION INVESTIGATIONS.

The results reported by cooperators using cultures of the nodule-forming bacteria for inoculating legumes indicate the continuation of a high percentage of successful inoculation. The description of convenient methods for distinguishing between the infection of crown-gall upon the roots of legumes and the development of the nitrogen-fixing nodules offers some opportunity for controlling the dissemination of crown-gall when the inoculation of legumes is attempted by the use of soil from old fields.

In the investigations in general soil bacteriology the study of cellulose destruction has for the present become of the greatest importance. Many new species of cellulose-dissolving bacteria and other fungi have been isolated, and it is believed that these are closely correlated with the development of nitrifying and nitrogen-fixing bacteria and therefore with the maintenance of soil fertility.

Through correspondence, various improvements have been suggested in water supplies and especially in the case of pollutions from odor-producing algæ. The most desirable treatment for the eradication of these organisms has been determined by the examination of samples shipped to the laboratory from the polluted supplies.

WORK ON DRUG PLANTS.

During the year the camphor work has progressed as rapidly as the nature of the problem would permit. Since the trees must make a growth of several years before the product can be utilized, the present task has consisted chiefly in growing trees for planting the experimental area and in setting out the stock already developed. Owing to the severe frost of the winter striking the newly transplanted stock at a critical time, considerable losses were experienced. This rather unusual result has led to a change in the handling of the young stock which it is believed will largely decrease the danger from this source. Laboratory and factory work has been continued with marked improvement in the experimental products.

The hop work has been directed toward the same objects as heretofore, and the results of statistical study of representative hop areas have corroborated the correctness of conclusions previously drawn. It seems clear that under current practice too few vines are trained to secure the maximum yield. Experimental work on different methods of pruning and fertilizing promises to develop important results also. The breeding work has gone far enough to show that among the large number of hybrid seedlings grown a number of new types have appeared which give great promise. A laboratory study of certain important hop constituents has shown that varietal or geographical characteristics can be detected which should simplify somewhat the problem of judging hop values. Further work along this line must be fruitful of most valuable results.

POISONOUS-PLANT STUDIES.

The field work of the year has covered two chief lines of activity: (1) Feeding work carried on with suspected plants at the field camp near Baldwin, Colo., and (2) visits to the national forests in which considerable losses due to poisonous plants were suspected. Feeding work has been continued with the species of Delphinium (larkspur) available in the vicinity of the feeding station, with species of Lupinus (wild lupine), species of Cicuta (water hemlock), and others. Several serious sources of trouble were demonstrated and means of greatly reducing the losses were worked out for the larkspurs. It is hoped this result may be of much value to the stock interests, since losses due to larkspur poisoning are very great and are experienced on practically all the cattle ranges in the western mountains.

Reconnoissance work on several of the national forests reporting the severest losses has been done, and in cases of plant poisoning it has usually been possible to indicate the source of trouble and often to suggest helpful measures.

On account of the urgency of the demand from stock regions of the West, this work up to the present time has been largely confined to that section of the country, but it is hoped to investigate in the early future a number of similar problems occurring in the East.

Laboratory work on the nature of the active principles present in poisonous plants and poisonous-plant products has been carried on chiefly at Washington.

The question of spoiled corn and its relation to pellagra has been under investigation, the agricultural side of the problem only being considered. Toxic substances have been isolated from cultures of organisms occurring on spoiled corn and some new constituents have been isolated.

PLANT PHYSIOLOGICAL INVESTIGATIONS.

During the year the problem of the storage of sweet potatoes has been actively investigated. The difficulty of keeping sweet potatoes has suggested a study of the physiological behavior of this product under different storage conditions in the hope of finding the cause of the weakness and of working out a convenient method of handling them for long-time storage.

A physiological study of certain pathological conditions arising in cabbage and spinach in prominent eastern trucking regions has been undertaken. The investigation has shown derangement in certain enzyme relations, and a method for accurately investigating these has been worked out. The curly-top of sugar beets has also been under study.

The physiological requirements of plants have been much investigated in the past, but certain new considerations have come to attention during late years, which have seemed to demand investigation of certain of these problems viewed from the new standpoints. Such a study has been undertaken with very suggestive results.

The chemical variability of certain important drug plants has been under investigation in the hope that uniform active products might be developed. A good basis for further work has been obtained, and the outlook for success seems good.

ALKALI AND DROUGHT-RESISTANT PLANT-BREEDING INVESTIGATIONS.

Investigations during the year have been in large measure directed toward ascertaining why some varieties of crop plants endure drought better than others, since it is evident that the best results in variety testing and breeding for drought resistance can only be attained when this problem is solved. It is practically certain that "root pull" is not an important factor, for extensive experiments have led to the conclusion that there is very little difference in the ability of the roots of plants from arid regions, as compared with those from humid regions, to extract water from a nearly dry soil. Economical use of the moisture available, as evidenced by the production of a maximum crop with a minimum loss of water in transpiration, is believed to afford the best criterion of superior drought resistance. An immediately applicable result of these physiological investigations is the working out of a method for testing in the field the comparative drought resistance of different species and varieties, which it is believed can be successfully used, even in wet years, thus greatly accelerating the progress of variety-testing and plant-breeding work.

As regards the indicator value of natural vegetation, the results of preliminary studies in the Intermountain or Great Basin region support the conclusion previously reached in the Great Plains area that the native growth is the safest guide to follow in selecting new land for agricultural purposes. Certain types of vegetation are found to characterize land that is suitable for "dry farming." Other types are a pretty certain indication that the water relations of the soil are unfavorable or that there is a dangerous quantity of alkali salts, even though the appearance of the surface soil may not indicate the presence of alkali.

Several bales of lint of the new Yuma variety of acclimatized Egyptian cotton grown in Arizona in 1909 and 1910 were purchased by one of the largest American firms which use this type of cotton at a considerable premium above the price obtaining at Boston on the date of sale for high-grade imported Egyptian cotton. The results obtained in spinning this cotton were highly satisfactory to the purchaser. This additional assurance of the good quality of the fiber, together with the satisfactory yields obtained at several different localities in the Southwest, justifies the conclusion that this Yuma variety is well adapted to the commercial production of cotton of the Egyptian type.

DATE CULTURE.

As the date trees of imported varieties now on trial gain in maturity, their true characteristics and adaptation to particular conditions become more apparent. The present year's results at Mecca and Indio have brought into prominence a few varieties favorably noticed for several years, but now definitely to be recommended for trial on a commercial scale.

With the fruiting of young trees grown from seed distributed to department collaborators a number of new varieties of decided merit are appearing, and certain imported sorts are showing an unusual proportion of meritorious seedlings. We now have also for the first time the opportunity of using pollen from male trees of known parentage, and date breeding along definite lines began with last spring's pollinations. Artificial ripening by a very inexpensive method has been carried to a perfection not heretofore attained, and the limited output of the Deglet Noor variety so handled commanded fancy prices.

The results secured by the department in date culture have stimulated considerable activity in date planting and the development of the industry bids fair to advance about as rapidly as the slow propagation by offshoots will permit.

CONDITIONS AFFECTING CROPS IN ARID REGIONS.

Serious misconceptions have developed regarding the possibilities of crop production in semiarid regions, owing to the lack of definite information regarding the prevailing conditions in such regions. The large yield reported from time to time in the daily press is that of the exceptional crop grown as the result of an unusually heavy rainfall or under such peculiar local conditions that it receives more than the normal water supply of the region. For this reason the department is making measurements at each of its semiarid experimental farms to determine as nearly as possible the exact conditions of temperature, rainfall, and evaporation under which each crop is produced. In addition, systematic measurements are made of the moisture content of the soil under different methods of cultivation and crop rotation, to determine what methods are most efficient in getting the rainfall into the soil and making it available for the growing crop. In this way we are able to determine the conditions under which each crop is produced and the effect of those conditions upon the yield. These measurements will be continued until sufficient information is obtained regarding conditions in each section where dry farming is being attempted. A preliminary report covering the results of the first four years' observations is now in preparation.

TOBACCO INVESTIGATIONS.

Experiments and demonstrations in improved methods of tobacco production have been carried out at local field stations in most of the leading tobacco-growing sections, and laboratory studies on the relation of the composition to the quality of the leaf have been continued.

The method which has been devised for applying artificial heat in curing cigar tobaccos has been used successfully during the past season by several growers in the Connecticut Valley. This system not only does away with all injury from pole sweat, but insures better and most uniform curing. Experiments with an improved system of ventilation for barns in the flue-curing districts have also given promising results.

In the export and manufacturing districts special attention has been given to the problem of securing an adequate supply of humus in the tobacco soils, which undoubtedly constitutes the key to improving the yield as well as the quality of the crop in nearly all these districts. This problem is of the greatest importance to the grower because of the fact that most legumes are likely to exert an injurious effect on the quality of the tobacco when preceding this crop in rotation.

An important feature of the tobacco work of the year has been a careful study of the effects of environment on the habits of growth of the plant and on the quality of the cured product, the principal object of this work being to afford a proper guide to the development of improved varieties by systematic breeding. The extensive studies relating to the plant-food requirements of the tobacco crop which have now been in progress for several years have been continued along the same lines.

INVESTIGATIONS IN POMOLOGY.

The work of identifying fruits has increased to a very large extent during the year, identifications being made of fruits from every section of the country.

A revision of the catalogue of the American Pomological Society is now under way. The value of this catalogue to the fruit interests of the country can hardly be overrated, since it has for years been the standard conservative authority upon the value of varieties for the whole country. The forthcoming revision will make the catalogue more comprehensive and exhaustive than ever.

Investigations looking to the simplification of fruit nomenclature have been pushed vigorously, resulting in the accumulation of several thousand card references to the history, origin, distribution, synonymy, description, classification, etc., of the cultivated fruits of the country.

The collection of fruit varieties at the Arlington Farm has been materially increased during the year. The collection is furnishing admirable opportunities for obtaining information at first hand concerning the relative merit of varieties.

Special attention has been devoted to the Persian walnut. Effort is now being made to introduce foreign varieties, to the end that a thorough test may be made of those that give promise of meeting the demands for an extension of the area of cultivation.

FRUIT-MARKETING, TRANSPORTATION, AND STORAGE INVESTIGATIONS.

Investigations on the marketing, transportation, and storage of fruit have consisted mainly of a study of the relation of handling methods to decay and deterioration in oranges and pomelos in Florida; table grapes, oranges, lemons, and apples in California;

and cherries, fresh prunes, and red raspberries in Oregon and Washington. The investigation of different methods of precooling table grapes, red raspberries, cherries, and fresh prunes in advance of shipment is also an important feature of this work.

The general principles underlying the relation of careful handling to the sound shipping and holding qualities of fruits have been found to apply to all classes of fruits thus far investigated, including even such perishable products as cherries and red raspberries.

VITICULTURAL INVESTIGATIONS.

The experimental vineyards established in different sections of California continue to yield important results, especially in determining the adaptability of various Vinifera grape varieties to different soil and climatic conditions.

FRUIT-DISTRICT INVESTIGATIONS.

The fruit-district work has been extended to cover the regions of Oklahoma, Kansas, Nebraska, northern Texas, and portions of New Mexico and Colorado. Ten years' phenological data have been accumulated and the results are being tabulated.

ARLINGTON EXPERIMENTAL FARM.

The Arlington Farm, which is the department's field laboratory in plant industry, is the largest intensive enterprise of this character in America. The farm is equipped with barns, tool sheds, and modern implements and is manned with men and teams for conducting the field investigations of more than 20 distinct offices and bureaus of the department. Besides this equipment there is upon the farm a bank of greenhouses consisting of 20 separate rooms or units devoted to experimental research work. A modern gravity brine-system cold-storage plant with a capacity of 700 barrels has been installed. Two types of drying apparatus, one for steam and one for direct currents of hot air, have been provided, as well as a plant for sterilizing soil and boiling spray mixtures.

TRUCK-CROP INVESTIGATIONS.

The development and maintenance of standard commercial varieties of vegetables particularly adapted to specific purposes is well under way with lettuce, cauliflower, cabbage, beets, tomatoes, and potatoes. During the last year standard commercial varieties of potatoes have been grown in each of the important commercial potato-growing regions. This stock has all been grown on the hill-selection tuber-unit basis. The work under way in the development of new varieties exceeds that of any former undertaking. There are in this collection over 25,000 distinct specimens or varieties.

The peanut investigations have caused rapid extension of the industry. From a beginning of a few hundred acres in 1908 the crop this year will require more than 300,000 acres in the Gulf States alone, where prior to the time mentioned no commercial industry existed.

GREENHOUSES, GARDENS, AND GROUNDS.

Two additional greenhouses of a temporary nature were added during the year, one being used to care for the citrus-fruit collection and another for physical investigations. A number of the worn-out asphalt walks in the grounds were replaced and worn portions of the macadam roads repaired. In order to avoid any possibility of danger from frost should there be a break in the underground heating main from the central power plant, two large second-hand boilers were installed adjacent to the greenhouses. Much attention was given to the lawns adjoining the department buildings in order to maintain them in good condition. A number of additions were made to the ornamental plantings upon the grounds.

OFFICIAL COTTON GRADES.

The preparation and distribution of the nine official grades of white American cotton, as provided by law, has been an important feature of the work of the Office of Plant Technology. These grades have been officially adopted as the basis of their operations by nine cotton exchanges, while the New England Cotton Buyers' Association and the Arkwright Club have agreed to make them the basis of all their purchases.

A meeting of the Southern Cotton Buyers' Association was held in Memphis, Tenn., at which it was unanimously agreed that the official grades would be made the basis of all quotations to these New England organizations. The representatives of several exchanges which have not formally adopted the official grades participated in this action.

The official grades have now been on sale for a little more than one year, and the number of orders received in the last half of this period is one-third greater than in the first half. Because of the increased demand and the perfection of facilities for the preparation of the grades, it has been found practicable to reduce the price of a full set to $30.

The work of placing 50 sets of these grades in vacuum storage for use as working duplicates in future years is being actively prosecuted. It is believed that by this means it will be possible to preserve indefinitely the exact standard which was originally adopted. This has never before been accomplished, and the inability to preserve the integrity of the standard adopted has been one of the principal causes of the failure of the attempts heretofore made by the various branches of the cotton industry to agree upon a uniform standard of classification.

With a view to encouraging improved methods in the ginning and handling of cotton, experimental and demonstration work on a commercial scale has been undertaken. It is hoped that these experiments will give an accurate measure of the increased value which can be given to the cotton crop by a more careful regulation of the speed of the ordinary cotton gin, by better bagging, the protection of cotton from exposure to weather, and by securing greater uniformity within the bale. The effects of storing seed cotton under different conditions and for different periods are also being investigated.

The improved method of measuring the length of cotton fiber which has been developed has justified all that has been hoped for it. The method has been demonstrated before important gatherings of prominent members of the cotton industry, and has been received with great interest and pronounced approval.

PAPER-PLANT INVESTIGATIONS.

During the year a total of about 3 tons of paper has been made from cornstalks, broom-corn stalks, nonsaccharine sorghum stalks, rice straw, properly retted and overretted hemp stalks, sorghum bagasse, canes from southern canebrakes, "rice-root" grass tops, and fish-pole bamboo. Good qualities of book paper resulted in practically all cases, and several of the materials have proved sufficiently promising as to yield of pulp and quality of paper to warrant more detailed investigation.

The results with cornstalks have been more encouraging, as higher yields of pulp in proportion to raw material have been secured. Special attention has been paid to securing food-extract by-products that may be used in feeding cattle. Several hundred gallons of cornstalk extract evaporated to the consistency of molasses have been produced, and preliminary feeding tests have been carried on with dairy cattle and hogs. From these it appears that the extract may have considerable nutritive value. The value of this by-product and the cost of securing it will probably determine whether or not cornstalks can become an important paper-making material in the near future.

FIBER CONGRESS IN JAVA.

In response to a request from the Netherlands Government, the botanist in charge of fiber-plant investigations was sent as a delegate to represent this Government at the International Fiber Congress and Exhibition at Surabaya, Java, held in July, 1911. The Fiber

Congress itself was the first international gathering that has been held for the general discussion of the production of plant fibers. The subjects were ably discussed by men who for the most part are actually engaged in operating fiber plantations and who therefore have an intimate knowledge of the many problems met with in the industry and also the many practical ways in which these problems are solved.

GRAIN STANDARDIZATION.

The results of the grain-standardization investigations pertaining to the methods of harvesting, handling, transporting, storing, and grading grain have been of unusual interest and value during the year. In this work special attention has been given to the methods of handling grain on the farm, in elevators and warehouses, and by transportation companies, including a study of the changes which take place in grain while in storage or during transit in cars or steamships, together with a study of the relative value of the factors taken into consideration by grain dealers and the manufacturers of grain products in fixing values and grades of commercial grain. These investigations have likewise included some preliminary work in the rice fields of Louisiana and Texas on the methods of handling and grading rough rice, with a view of reducing the immense losses now experienced in handling this important crop.

Continued investigations during the year have fully confirmed the conclusions originally drawn that moisture is the most dangerous factor in the handling of commercial grain. Extensive experiments made to determine the natural shrinkage of grain when handled in elevators or warehouses or while in transit in cars have shown losses in weight due to the evaporation of moisture ranging from one-tenth of 1 per cent to more than 7 per cent.

Detailed tests of more than 10,000 representative samples have shown that a very high percentage of the 1911 crop of corn contained more than 20 per cent of water at the time of marketing, thus emphasizing the urgent need of better methods of handling grain on the farm and of growing types of corn that will mature sufficiently early to permit the grain to be marketed in a dry, sound, and more satisfactory condition. The degree of deterioration in corn alone, due primarily to excessive moisture, results in a loss equivalent to more than a million dollars annually, much of the corn handled commercially becoming musty, sour, hot, and badly damaged.

During the latter part of the year an informal invitation was extended to grain exporters and representatives of railroad and steamship companies interested in the handling of export grain to participate in an informal conference at the department for the purpose of discussing the results of special observations on seven cargoes of export corn aggregating more than one and one-half million bushels. This invitation met with a most cordial response, and the 29 delegates present took an active part in discussing the results of these investigations, with a view of improving the quality and conditions of American export grain.

SEED-TESTING LABORATORIES.

On account of the provision for seed testing made by State laws in North Carolina and Nebraska, cooperation with these States has been discontinued, and two new laboratories are being opened in connection with the agricultural experiment stations in California and Louisiana, the laboratories in Missouri, Oregon, and Indiana being continued.

Hairy-vetch seed, which has this year for the first time been collected for examination for adulterants, was frequently found to contain seed of cultivated varieties of spring vetch, the latter generally being useless for fall sowing on account of winterkilling. An examination of the hairy-vetch seed-growing section of northern Germany and northwestern Russia shows that on account of the difference in time of ripening it is impossible to harvest seed of cultivated forms of spring vetch and hairy vetch together, the former being used as an adulterant. The *Vicia villosa* seed originating in the Baltic Provinces occurs as a volunteer in winter rye and is separated as cleanings from the rye.

PROGRESS IN CORN INVESTIGATIONS.

Requests for information concerning the corn crop, received by the department, were much greater in number and variety than during any previous year. In cooperation with interested farmers in many of the principal corn-growing States work is in progress which has as its object the development of higher yielding strains of corn. In connection with this work demonstrations are made of methods of breeding, methods of seed selection and preservation, methods of planting and cultivating, as well as tests of soil preparation and tests of cover crops. This cooperative work with individual farmers has resulted in the development of a number of higher yielding strains of corn and in stimulating throughout the localities an interest in better methods and higher acre yields. In a number of instances this work has resulted in a very noticeable increase in the production of corn per acre throughout the community.

There is perhaps no other crop capable of giving so profitable a return from both investigation and demonstration work. The past season's work shows more plainly how very responsive this crop is to judicious treatment and how very little we have systematically studied its requirements. When the conclusive demonstrations conducted during the year in a few localities are conducted in many localities, a sufficient percentage of corn growers will profit by the demonstrations to cause a general improvement in the acre yield of corn.

CEREAL IMPROVEMENT.

Adaptation and breeding work with all the cereals has been continued during the year with special emphasis on the production of hardier and more drought-resistant varieties and strains. The superiority of many of the drought-resistant cereals was markedly shown in localities where drought was severe. The Turkey and Kharkof varieties of winter wheats did especially well, while Swedish Select oats and Ghirka spring wheat showed much superiority over less resistant varieties. The total production of the Kharkof wheat in the United States must be at least 40,000,000 bushels. Durum wheat continued to be the leading grain crop in the dry wheat-producing sections of the West and Northwest, where winter varieties are not yet dependable. The use of durum wheat flour is steadily increasing, and this product can now be purchased in a number of eastern cities. The season's work has furnished some good results with proso millets, particularly under irrigation, but also under dry-land conditions. Emmer, because of its better adaptation, still gives evidence of being a valuable crop in localities a little too dry for other stock food, such as oats and barley.

For the work in dry-land grain investigations two new experiment farms have been added, one at Burns, Oreg., and one at Aberdeen, Idaho. These farms will be managed in cooperation with the experiment stations of these States. During the year, for the first time, experiments with grains under irrigation have been undertaken. These experiments are conducted at points where it is possible to compare the results obtained with similar varieties under dry-farming conditions.

The grain sorghums are proving increasingly important as stock foods for dry-land areas. The dwarf and early varieties, such as Dwarf milo, Dwarf Blackhull kafir, Sudan durra, and the kowliangs which have been bred and distributed by this department are giving surer yields under conditions of greater drought than were formerly possible. They also permit the extension of these grains into more northern States, as South Dakota, Idaho, and Oregon.

In rice investigations in the South special attention has been given to solving the problem of controlling red rice by proper rotations and cultivation. In California experiments with rice were conducted at nine different points, and the results already obtained indicate that commercial rice production may be possible on large areas in the Sacramento Valley and on smaller areas in the San Joaquin Valley. Preliminary irrigation experiments with rice show the probability of obtaining more profitable yields of this crop with much less irrigation water than is commonly used. Promising results have also been obtained in the investigation of growing rice without irrigation on the prairies of Florida. Experiments with Arlington Awnless winter barley have progressed with considerable success. Seed of this hybrid has been sent to all the experiment stations in the South and West where winter barley would likely be adapted, and in many cases excellent success has been reported. Owing to its high stooling qualities this variety gives promise of becoming very productive.

DRY-LAND AGRICULTURE INVESTIGATIONS.

Another year of severe drought throughout a considerable portion of the Great Plains region has shown the value of the investigations in crop rotations and cultivation methods in this area. These investigations have shown that, while much may be accomplished in the way of moisture conservation by proper methods of cultivation, none of the much-advertised methods and "systems" which have been so vigorously exploited through the public press can insure crops against droughts as severe as those experienced at some of the stations during the last two seasons. At those stations where the drought was less severe some remarkable differences in yields were obtained where proper methods of cultivation and crop sequence were followed. The results of the past season's investigations strongly confirm the tentative conclusions published in Bulletin No. 187 of the Bureau of Plant Industry. They also disclose several new problems which demand solution and which will be attacked during the coming season.

The high appreciation of this line of work by those interested in the agricultural development of the Great Plains was evidenced by the substantial increase in the appropriations made by the last Congress for its development and extension. The Comptroller of the Treasury has ruled, however, that, owing to a slight defect in the last appropriation act, the funds appropriated "for the investigation and improvement of methods of crop production under semiarid or dry-land conditions" can not be used for the erection of buildings necessary for carrying on these investigations at the field stations. It is hoped that the next Congress will remedy this defect early in its session, in order that the current appropriations may be used for this purpose. If this is done, active operations will be begun at several new stations early in the coming spring. These stations are located in Fall River County, S. Dak.; near Tucumcari, N. Mex.; and in the southern portion of the Panhandle of Texas. It is absolutely essential to the development of this important line of investigations that suitable buildings be erected, and unless the funds already appropriated are made available for this purpose the contemplated extension can not be made until July 1, 1912, thus causing the loss of an entire season's work at these new stations. Such a delay at this time would be very unfortunate, as these stations are in localities where the drought has been very severe for the last two seasons and the settlers are therefore in urgent need of all the assistance that can be given them by this department.

WORK OF THE FIELD STATIONS AT THE RECLAMATION PROJECTS.

The opening of the reclamation projects to settlement has disclosed many problems of a local character which must be solved before these projects can be brought to their highest state of productiveness. In order to assist in the development of this region, the department has established experimental farms upon the following projects: Yuma (Arizona, California), Truckee-Carson (Nevada), Umatilla (Oregon), Huntley (Montana), North Platte (Nebraska), Williston (North Dakota), and Bellefourche (South Dakota). Experiments to determine the tillage methods and crop rotations best adapted to the conditions constitute an important part of the work at these stations. Special attention also is given to the utilization of native forage and fruit plants and to the testing of special crops that seem peculiarly fitted to the different conditions.

Irrigated regions present problems in plant nutrition and crop production that are not met elsewhere. A marked diminution in yield after cultivation for a few years is by no means an uncommon experience in irrigated regions. These troubles are often the result of the translocation of the large amount of soluble material that is usually present in irrigated lands, but there appear to be other causes not well understood which give rise to a condition of malnutrition in the growing crop. Particularly is this to be seen in the case of irrigated orchards. It is highly desirable to undertake at once a comprehensive investigation of the conditions giving rise to malnutrition of crop plants in irrigated regions if we wish to maintain our irrigated lands in a high state of productiveness.

Some serious pathological problems have also developed on some of the projects, notably a disease of the potato which has proved very disastrous on the North Platte (Nebraska) project. These problems are undoubtely closely associated with the time and manner of applying irrigation water and also with the quantity of water applied. The previous crop grown upon the land seems also to be an important factor in causing these diseases to develop. These various problems and their interrelation are to be carefully studied through cooperation among the several offices of the Bureau of Plant Industry having charge of the respective lines of investigation.

FORAGE-CROP INVESTIGATIONS.

Notwithstanding the fact that rapid and material improvement has been made in agronomic methods and in practically every phase of farming, almost no advancement has been made in the management of farm pastures. This is apparently due to the lack of a full appreciation of their value, for it is a fact that pastures will stand neglect to a greater extent than any other portion of the farm and that the results of care and treatment are not so readily noticeable as in the case of cultivated crops. The careful investigations that have been under way for the last four years are now beginning to point to methods of management that will very materially increase the income from pastures that are now unprofitable. The optimum rate of grazing pastures seems to be one of the most important factors in connection with their management. In carefully conducted tests very light grazing as well as very heavy grazing has proved injurious. The value of alternate grazing and surface cultivation has been measured under carefully controlled conditions, and data have been accumulated to form a basis for reliable recommendations.

A new forage crop to become popular in any section must possess points of superiority over forage crops that are already well established. This season two new grasses, Rhodes grass and Sudan grass, have proved to be so superior to other grasses for the same conditions that they are being accepted at once in sections where they have been tested.

The ability of Rhodes grass to produce heavy yields of palatable and nutritious hay in Florida and other parts of the Gulf coast region, where a good hay grass is a valuable desideratum, makes this grass one of the most promising of recently introduced plants.

Sudan grass, introduced from Africa, is another example of a new forage crop that has become popular almost in one season. This grass apparently possesses all the valuable characteristics of the well-known Johnson grass without being at all troublesome as a weed on cultivated land. Sudan grass is an extremely promising grass not only for the South, where Johnson grass is now being grown, but also for sections farther north as an annual crop to replace millet. It is a very drought-resistant species and gives heavy yields of good hay.

A new variety of velvet bean promises to become a valuable crop for forage and soil improvement in sections that are considerably north of those now producing the Florida velvet bean. While further tests of this variety are necessary to determine its value and northern limit, the present indications are that it will become a very popular and profitable crop as far north as southern Arkansas.

INVESTIGATIONS IN FARM MANAGEMENT.

This important work will be grouped under four principal heads: (1) Studies of farm practice; (2) cost accounting and farm records; (3) farm equipment; and (4) farm problems, or extension work. In the studies of farm practice, much additional information has been secured concerning the relation of farm practice to crop yield, the relation of methods of tillage to crop yield and to soil and labor conditions, and the relation of cropping systems and methods of tillage to weed control. Particular attention has been given to the relation of crops to the general distribution of labor on the farm. An important phase of the work of farm management has to do with the problems of the farmer or the application of all the data secured to the individual farm. From most of these farms similar records were secured last year. These records show the cost of every kind of farm operation under widely varying conditions of management. They also show the dates at which all work is done and the number of men and horses required to perform each operation economically, and hence they are of great value in formulating working plans for farms. A careful study has been made of the capital invested, the elements of cost, and the sources and amount of income on all farms in several representative townships in three Middle Western States. These studies give important information on the types of farming best adapted to that section, the relation of successful management to the training and education of the farmer, the average percentage of profit on the investment, the relation of profit to the seasonal distribution of labor, and many other important problems connected with the organization and conduct of the business of the farm.

Studies of the character and cost of all phases of farm equipment and the distribution of capital among the elements of equipment, such as land, buildings, fences, live stock, and implements and machinery, have been conducted on a large number of farms in several widely separated localities. In connection with the studies of cost accounting and farm records, investigations have been made of all the operations on a large number of farms. The reorganization and redirection of agriculture in the various sections of the country is a task calling not only for broad knowledge of the sciences which are fundamental in agriculture, but also for an intimate knowledge both of farm practice and of the problems confronting the farmer in any given section. Changes in farm practice in many localities are imperative for the good of the farmer as well as for the general welfare. In many places the practice of unwise methods has resulted in marked decrease in the yielding power of the soil. In nearly all of the older States there is a noticeable decrease in rural population. The growth of urban population and the development of transportation facilities have made important changes in the demand, and hence in prices, of farm products, rendering changes in types of farming desirable and necessary. The problem of tenant farming is pressing for solution. As the older men retire, the young men having largely entered other callings, it becomes necessary to rent the farm. The tenant is usually without the capital necessary to equip for live-stock farming; he therefore exploits the farm and then moves on to exploit another. This problem must receive attention. Systems of tenant farming must be evolved that will give consideration to the future productiveness of the soil.

The necessity for important modifications in farm practice and the reorganization of the agriculture of many sections is becoming generally recognized and public interest is being awakened. This is one of the most important phases of the work of this department. An organization has been formed and men have been trained to lead in this work. We are now ready to extend this work. In doing this we propose to cooperate as closely as possible with all those agencies in the several States which are interested in work of this character.

FARMERS' COOPERATIVE DEMONSTRATION WORK.

The farmers' cooperative demonstration work has been developed into a system for carrying information to the farmer on his own farm. It has as two of its strongest points the carrying on of demonstrations in the production of standard crops under the best-known methods on the land of the farmer being instructed and the securing of such active cooperation in the demonstration on the part of the farmer as to bring about the adoption of the method advocated. After seven years of experience and development it has grown into a great and successful institution. Not only has it been successful in showing the southern cotton farmer how to meet the ravages of the cotton boll weevil, but it has spread abroad through southern agriculture lessons of great value, and rapid strides are being made in that section in diversified farming, the keeping of live stock, and the building up of soil fertility. From the great extent of this work and the years of experience the department has had with it, it may safely be said at this time that when intelligently directed this method of disseminating agricultural knowledge proves successful and secures the allegiance of the educated and progressive farmer as well as the poorer classes and negro tenants.

One important branch of this work has been the boys' corn club movement. This has attracted much attention, and has served as a means of stimulating general interest in better agriculture in the South and better knowledge of its great agricultural resources. Corn clubs were organized in other States for some years before they were started by this movement in the South, but nowhere have they been organized more systematically or successfully. The numbers have increased from a small beginning four years ago until the present enrollment is practically 60,000. Prizes are awarded for excellence in growing corn on one acre to be contested for by boys organized into clubs in cooperation with the public-school system of States and counties. The prizes are contributed either in money or useful things by merchants, commercial organizations, public-spirited individuals, and others. One of the strong features has been the method of awarding prizes, the prizes not being given to the boy who raises the most corn on his acre, but the practical and educational value of the lesson is kept in mind, and in making up the award emphasis is given to best yield, minimum cost of production, quality of corn produced, and best written report of the undertaking. The prize winner in each State as a rule has part of his reward in a prize trip to Washington, where the boys gathered from the several States receive much attention and have opportunity to see and study the interesting things in the Capital City. These clubs are helpful in attracting the attention of the young men to the advantages of farming as an occupation, in waking up the older farmer to the advantages of better methods of production, and in assisting the public-school system in vitalizing rural education. In the States of North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana, and Arkansas this boys' corn club work has been carried on by the Farmers' Cooperative Demonstration Work in direct cooperation with the agricultural colleges of each of those States.

As the home is the all-important feature of farm life and is closely associated with its economy, it has been thought wise to help the girls as well as the boys. The problem of the production of home supplies is close to the home. With the great possibilities the South has for the production of vegetables and fruits and with the modern conveniences accessible for canning and preserving them, it is possible to have provisions of the best kind the year round. This and the keeping of poultry go far toward relieving the wrong side of the family ledger. Girls' canning and poultry clubs have been organized by the department in cooperation with colleges of agriculture and other institutions in the South, the object being to instruct the girls in the best methods of raising the ordinary garden vegetables, canning the same for winter use, and the care and keeping of poultry. This work is financed by the General Education Board of New York, with the hearty financial cooperation of the agricultural colleges of the South, and to it, through the demonstration work, the department is lending its guiding assistance. This work has only just begun. Prizes are offered in the same way as in the corn clubs, and the girls and farm women of the South are showing great interest in this branch of the work.

PROGRESS IN PLANT INTRODUCTION.

The striking fact that the vast majority of valuable varieties of our cultivated crop plants have originated by chance and been discovered by private individuals seems to warrant the encouragement throughout the country of private testing gardens as well as official ones, in which newly introduced plants can be grown and closely watched by intelligent and interested people. It is not deemed expedient as a policy to support these testing gardens with Federal funds, but to supply the plant material which is propagated in extensive propagating gardens, and in this way encourage the building up of permanent collections and arboreta which shall be supported by State appropriations or private endowments.

In order to encourage those thoroughly interested in the testing of new plants and their use in the creation of new varieties, plant introducers are sent out to visit the various gardens and bona fide private experimenters. They arrange for the placing of the valuable plants, interpret the results, suggest new and promising fields of investigation, and report on the demands for foreign plants with which to work.

In addition to the State experiment stations, permanent places for the testing of long-lived perennial plants have been found in city parks, the grounds around many public institutions, and the farms connected with the Indian reservations. By this method a wider circle of experts and amateurs is being reached than would be possible by the building up of a few large collections, in that it brings to their own gardens new plants upon which they can experiment and which they can breed with our native species.

An agricultural explorer has during the year explored the cold dry regions of Chinese Turkestan and crossed the Tien Shan Range into Siberia and obtained wild apples, pears, bush cherries, and other fruits and forage plants which can not fail to be of value to the breeders of hardy plants in the Northwest.

CONGRESSIONAL SEED DISTRIBUTION.

Seeds and plants were distributed upon congressional order as in former years. Between six and seven hundred tons of vegetable and flower seeds, put up in approximately 60,000,000 packets, were distributed the past season. Of this quantity about 10 per cent was flower seed and 90 per cent vegetable seed. Approximately one-third of the total quantity was procured from surplus stocks, and the remainder was grown under contract for the department during the current season. In every case seed was secured on competitive bids, and no seed was accepted for distribution unless it was found after repeated tests to be of satisfactory purity and vitality. Every lot of seed is tested for germination two or more times before and after shipment, and a sample of each lot is grown on the trial grounds of the department under the direct supervision of expert horticulturists to determine its trueness to type. Many thousand pounds of vegetable and flower seeds which do not meet the requirements of the department are rejected every year and returned to the seedsmen by whom they were shipped. Where seeds are contracted to be grown for the department the fields are inspected at the proper season by specialists, who see that the plants are uniformly true to type and that a proper system of roguing out variations and mixtures is followed. This system has resulted in steady improvement in the quality of seeds distributed by the department, as shown by the results obtained on the trial grounds and by hundreds of reports from all sections of the country.

The work of packeting, assembling, and mailing the vegetable and flower seeds was done under contract at a cost of $1.10½ per thousand packets, which included delivery of the packeted seed in mail sacks direct to the Union Station. A new contract has been entered into for putting up and mailing the seeds for the coming distribution at a saving over the former contract of 1 cent per thousand packets.

Approximately 12,000 pecks of four improved varieties of Upland cotton developed by the department were distributed in the cotton-growing States last season. The continued distribution of these improved cottons, with the accompanying circulars which contain detailed instructions for the home selection and improvement of seed, has resulted in widespread interest in seed selection in the South.

The propagation of Dutch bulbs in the Puget Sound region in connection with the congressional distribution is progressing favorably. Trial sets of narcissus and tulip bulbs propagated near Bellingham, Wash., were planted at Washington, D. C., with sets of bulbs of the same varieties imported from Holland, and the Bellingham bulbs produced better blossoms 10 days earlier than the imported bulbs. The early blooming period of American-grown bulbs is of importance to all professional florists, because of the saving in time and fuel where bulbs are forced for market.

BUREAU OF CHEMISTRY.

FIELD WORK AND SCIENTIFIC STUDIES ON HANDLING POULTRY AND EGGS.

The Food Research Laboratory has for another year pursued its policy of working out in the laboratory the fundamental scientific facts pertaining to the handling of poultry and eggs and of applying these facts to industrial problems by practical work in the field with all the branches of the industry. No problem of gathering, killing, chilling, shipping, holding, etc., is without meaning in this investigation, and all the work done has been of value to the consumer and to the industry in the betterment of the product and in securing more stable financial returns. Throughout the industry there is not only the spirit of cooperation, but an effort to push the inquiries and obtain information as rapidly as possible because of the growing appreciation of the value and the necessity for work on the betterment and conservation of perishable foodstuffs. The specific problems attacked this year have included a comparison of the effects of "dry packing" with water chilling and "ice packing," extensive field and shipping experiments having been made from plants in Atchison, Kans., and in Nashville, Tenn., to New York, with careful inspection and laboratory examination from the killing until marketing is completed. The results obtained are of the utmost practical value, and in the course of the work a mass of scientific data on the composition of fresh chicken flesh and the bacterial and chemical changes in same due to temperature have been obtained. The same data under conditions of routine marketing have been determined. Other problems of handling have included methods of killing and a comparison of the rate of decomposition of drawn and undrawn poultry, based on experimental work and bacteriological and chemical examinations, while some of the transportation and storage features of the problem have been discussed.

The practical results of the scientific work and the industrial application of the same are given to the industry as promptly as the facts become a certainty. Publication of the details of all the work is made according to the class of readers to which it especially applies. But the essential facts, which will help at once to get better poultry to market, are given to individuals or organizations or in answer to inquiries whenever they can be helpful, since this work is essentially for immediate betterment all along the line.

A demonstration of killing, picking, chilling, packing, and shipping poultry and also of the details of candling and handling eggs was given at the present field laboratory, which is in a packing house at Nashville, Tenn. The interest manifested by the shippers, their keen appreciation of what the work meant to them, and especially of its value in the development of the poultry and egg industry in Tennessee and Kentucky, was extremely encouraging. This demonstration was followed by an illustrated talk in New York, that the receivers might know of practices prevailing in the producing sections and have a more definite knowledge of the reasons for the condition of their poultry receipts. As a practical supplement to this talk a shipment of poultry killed 1,000 miles from New York, dressed in various ways and shipped under refrigeration, was exhibited in one of the chill rooms of a refrigerated warehouse, the birds showing, even to a casual observer, the difference in condition due to different modes of handling.

The studies of the handling of eggs and the preparation of the frozen and desiccated products are proceeding along lines similar to those followed in the poultry investigation, but as yet they are in an incipient stage. The frozen-egg investigation has met with the hearty support and cooperation of the progressive men of the industry. Everyone familiar with weather conditions and egg handling as at present conducted in the Central West knows that the waste of this most valuable foodstuff is appalling. It is imperative, in the face of the growing shortage of our food supply, that this waste be lowered by every means possible. Many eggs wholesome when received by the shipper are rotten after the long railroad haul to the center of consumption. Such eggs should have been wholesomely conserved for food, and, on the other hand, eggs which have deteriorated below the food line must not be packed for food purposes by the careless, incompetent, or greedy packer. This, like the general poultry and egg handling problem, is a problem of, first, scientific investigation, and, second, practical education and application of scientific principles. The present efforts are "breaking prairie" in the broad expanse of work to be done on the betterment and conservation of perishable animal products. So far the results have amply upheld the methods used. The plans for future work are comprehensive, and because of a growing understanding of the problems to be met and the methods available the results to come should be increasingly valuable, both economically and from the standpoint of public health.

FRUIT PRODUCTS.

Economic studies on the utilization of surplus fruit juices and the yields obtained by preparing the juices of various fruits in different ways have been made in collaboration with the Bureau of Plant Industry on a scale rendering the results commercially practicable. Special points considered were the effect of sterilization on the flavor of citrus fruits, the preparation of dried sugared pineapples on a large scale, and a laboratory investigation of the ripening of persimmons without softening, which is to be extended to field work, since the results indicate that instructions for commercial processing may be given which will greatly increase the market for this fruit. The studies on fruit respiration have included this year the effect of temperature on vital processes, the results being of economic value in their bearing on the storage and transportation of fruit.

The manufacture of citric acid, oils, etc., from waste citrus fruits has been made the subject of a laboratory investigation, mechanical devices for lessening the cost of production have been planned, and the results will now be tested by experiments on a commercial scale.

In the Enological Laboratory economic studies in the utilization of waste apples and grapes and the improvement of the by-products of these crops are made. To this end the composition of American grapes and apples in the different fruit districts of the country is determined, and a critical study is made of commercial samples in comparison with pure products of known history. The study of yeasts and the preparation of pure cultures for practical use in producing high-grade ciders, etc., is an important item in improving quality. These yeasts were distributed to 13 of the chief fruit-growing States during the year for experimental use by persons interested in the production of fruit by-products. A permanent laboratory at Charlottesville, Va., and a field laboratory at Sandusky, Ohio, make it possible to perform this work in a practical as well as a scientific manner, insuring results of value to the growers and manufacturers.

INSECTICIDES AND FUNGICIDES.

The investigations to discover new insecticides and improve those in use so that their efficiency may be increased and the injury to trees and fruits diminished may well be included among the important economic chemical investigations, inasmuch as the saving to the farmer, both in initial expense and in protection of the crop, is enormous. Exhaustive investigations along this line have had to do with the solubility of Paris green and lead arsenate in water, involving 3,500 arsenic determinations; the problem of fumigation with hydrocyanic acid gas, the results of the study, which are of considerable economic importance, being already published as Part III of Bureau of Entomology Bulletin 90; and the accumulation of toxic compounds in the soil as the result of using poisonous elements, especially copper and arsenic, in sprays. A new phase of this work, which should result in marked improvement of the commercial insecticides and fungicides found on the market, is the chemical and microscopic examination of these materials under the insecticide act, which went into effect on January 1, 1911, and aims to prevent the misbranding and adulteration of these commodities. In connection with this work about 418 samples were examined, involving some 2,800 determinations, the greater part of these being made at the request of the Bureau of Entomology. The improvement and discovery of suitable methods of analysis for the performance of this work is of fundamental importance, and much time is devoted to researches of this kind, about 600 determinations having been made to this end during the year.

CONSERVATION OF TURPENTINE, ROSIN, ETC.

The work which has been in progress for several years on wood turpentine and other products obtained in the distillation of wood has been so far advanced that its publication is deemed advisable. This work shows how the number and value of the products obtained in the distillation of wood can be increased, how the quality of the products may be improved, and the cost of the products decreased. Properly refined wood turpentine has been found to be a suitable paint and varnish thinner for all but the highest grade varnishes, and it may safely be used by the workman in well-ventilated places.

The work on the misgrading of rosin has developed the fact that such misgrading is largely due to the practice of cutting the samples on which the rosin is graded too large, and also to the fact that the standard type samples with which the rosin to be graded is compared rapidly bleach out and become lighter in color under the severe climatic conditions existing in the South. The indications are that in the neighborhood of 400,000 barrels of rosin are annually misgraded from the above-mentioned causes, and the loss occasioned by such misgrading is chiefly at the expense of the rosin producer. In order to prevent this as far as possible, a simple device has been prepared with which the producer of rosin can himself accurately grade his product and in this way check the subsequent official grading.

EXAMINATION OF CONTRACT SUPPLIES.

The testing of deliveries to the various Government departments of paper, textiles, leather, turpentine, rosin, and other materials has steadily increased, thus showing a gratifying appreciation of the help which the Bureau of Chemistry can render the other departments. Frequent calls for advice in the purchase of the above-mentioned materials and for service on inspection committees are received, and the assistance which has been rendered in the preparation of specifications and in the testing of supplies has saved thousands of dollars annually to the Government. These specific materials are examined in the Leather and Paper Laboratory, all other contract supplies being examined in the Contracts Laboratory, devoted exclusively to such work. A total of 2,309 samples were examined in the Contracts Laboratory last year. Of these over 1,300 were colors, paints, fats, and oils, principally for the Bureau of Engraving and Printing; 301 samples were examined for the Department of Agriculture; 1,217 for the General Supply Committee; and 310 for the Isthmian Canal Commission.

INSPECTION OF FOODS AND DRUGS.

The inspection force of the Bureau of Chemistry collected 9,500 official samples of foods and drugs during the fiscal year, and 2,000 additional samples for use in scientific investigations relating to the enforcement of the food law, providing data on which 312 seizures were based. Each of these samples was referred to the appropriate laboratory at Washington or to one of the 21 branch inspection laboratories, the reports from the latter points showing that 3,280 interstate samples were found to be legal and 3,113 misbranded or adulterated, while 503 check analyses were made to insure that correct results were obtained before recommending action on the samples. In connection with this work 5,370 hearings were held, less than half being by correspondence. There were 96,129 floor inspections made of imported products, of which over half were made at New York. A total of 9,698 imported foods and drugs were analyzed at these ports, of which number 3,085 were adjudged adulterated or misbranded and 1,268 were released without prejudice to future shipments. The miscellaneous samples examined at the branches aggregated 1,406, making a total of 18,000 samples.

In this connection there must be considered the analyses made at the Washington food and drug inspection laboratories and at the special laboratories handling specific classes of materials, such as the dairy products, waters, cattle foods, flavoring extracts, and essential oils. Here check analyses are made and all cases prepared for the consideration of the Solicitor, in addition to the original analyses made for inspection or investigation work. Approximately 752 samples are reported by the drug-inspection laboratories, of which 529 were domestic products; 231 of these were found to be adulterated or misbranded. The Food Inspection Laboratory proper reports 2,067 domestic samples and 1,097 imported foods, largely check samples on branch laboratory reports; in this laboratory 2,142 cases were prepared for consideration. In addition the Food Technology Laboratory reports 108 initial and check samples and 185 cases prepared on extracts and essential oils; the Dairy Laboratory reports 320 official interstate and import samples and the preparation of 347 cases; the Water Laboratory 200 samples, only 39 being of foreign origin, of which 11 were misbranded, while 39 of the 161 interstate samples were considered illegal and 6 seizures were made; of the 500 interstate samples of cattle and poultry foods 76 were found to be adulterated or misbranded. This total of 3,672 domestic and 1,302 import samples at the Washington office gives a general total of 22,974 samples examined in the course of the inspection work alone, including check examinations and other necessary duplications in the work.

DRUG INVESTIGATIONS.

The important cooperation with the Post Office Department in issuing fraud orders against medicinal agents sent through the mails and proved to be of a fraudulent or injurious nature has been continued. As in former years, the consumption, cancer, and epilepsy "cures" continue to form the most important classes of materials handled.

DAIRY PRODUCTS.

While the whole range of dairy products is covered by the examinations made, the evaporated and condensed milks and cheese formed the bulk of the samples examined at the Washington laboratory. An investigation begun in 1909 in regard to the concentration of evaporated milk was completed, and Food Inspection Decision 131 has been issued on this subject. Condensed milk, both sweetened and unsweetened, continues to be made in many instances from skimmed milk; the violations in the cheese trade consist most frequently in short weight or the sale of a skimmed cheese for a full cream. A total of 347 cases were prepared during the year on such products, nearly 200 of which are milks and creams, 44 cheeses, and 40 ice creams.

WATERS.

Mineral and table waters are examined both at source and as found on the market. As a result of the analysis of 161 domestic samples, 39 were found to be adulterated or misbranded and 6 seizures were made, while of the 39 imported waters, the exclusion of 11 was recommended. In this connection an extensive survey of the mineral waters of the United States has been undertaken and the data in regard to the waters of the New England States have been issued as Bureau of Chemistry Bulletin 139. This material is of the utmost value to physicians and consumers, especially those depending on the waters for any therapeutic effect, as well as to those called upon to pass on these waters in the enforcement of the law. Correlated studies include the analysis of public water supplies, investigations for the improvement of methods of water analysis, the character of chemicals used in water purification, etc.

CATTLE FOODS.

The studies of cattle foods and grains are by no means confined to the aspect of adulteration, since economic problems, such as the feeding value of forage crops and the composition of grains and cereals, form the fundamental part of the work of the laboratory charged with this subject. Of the 891 samples examined, however, 500 were interstate samples of cattle or poultry foods, and 76 of these were found to be adulterated or misbranded.

SUGAR AND SUGAR PRODUCTS.

The investigation of maple products begun two years ago is nearing completion, the season for the work being so short that the yearly results obtained at the camps are necessarily limited. A mass of analytical data has been determined on samples collected in different parts of the country and manufactured under varying conditions. The data on maple sap sirup have been published as Bureau of Chemistry Bulletin 134, and those on maple sugar and maple-sugar sirup are being compiled. Numerous practical problems attending the collection of the sap and the manufacturing processes are being studied, notably the effect of souring of the sap and of the use of different materials for sap containers and evaporators on the final product.

The studies of the effect of environment on the composition of sugar-bearing plants was extended to include muskmelons, the work being conducted in eight different States, representing widely differing climatic conditions, from Florida to Connecticut and from Arizona to New Jersey. Valuable results, such as were obtained in the five-year experiments on sweet corn and sugar beets, are expected, but no conclusions can be based on one year's work.

Miscellaneous sugar investigations include work on the moisture content of Louisiana cane sirup and molasses, the adaptation of methods of analysis of sugar beets to commercial needs, the chemical examination of imported honeys, and the analysis of American glucose and starch sugars.

PLANT PHYSIOLOGICAL CHEMISTRY.

The influence of environment on the chemical composition of various cereals, such as wheat, rye, oats, barley, buckwheat, etc., is studied in analyzing the crops grown in different localities during a number of seasons and in comparing the data on composition thus obtained. Thousands of such analyses have been made, and a report is in progress. Wheat is also grown under varying conditions of sun and shade, and plants grown in the Great Plains area are examined to determine the effect on composition of different methods of handling the crop, especially the influence of rotation on production. The composition of different varieties of barley grown in the same location for several years has been studied, and milling and baking experiments are supplementing the chemical work done to determine the comparative value of different wheats. The starch content of different varieties of potatoes is determined with a view to selecting the best varieties to be grown. These studies are made in collaboration with the Bureau of Plant Industry.

Important physiological studies have included experiments in growing cereals, usually wheat, for a few weeks in water solutions containing different plant foods, and, by the determination of their composition and that of the residual solutions, arriving at important data as to the physiological process of the young plant and its needs. In the same way the effects of different conditions are observed on the root formation of young plants, certain salts having been observed to have a deleterious effect.

The study of starches obtained from different plants, especially with a view to obtaining a more complete extraction than at present, an investigation of the graham flours on the market to determine whether they are mixed or straight, and baking and chemical tests of the availability of cottonseed meal, peanut meal, soy-bean meal, etc., in bread making, are miscellaneous lines of work pursued in connection with the other cereal studies.

ANIMAL PHYSIOLOGICAL CHEMISTRY.

The most important investigation along this line is perhaps the collection and analysis of about 30 different brands of infants' foods, supplemented by feeding experiments on small animals, using the commercial formulas for preparing the foods and also certain modifications. The detailed data are being collated, and some of the results already have been profitably used in charted form for the information of societies interested in this problem, which is of great importance in the conservation of public health. Other problems attacked by work along these lines include the methods of determining deterioration in meat and fish, a study of beef and yeast extracts of known and unknown origin, and the determination of the solubility in the digestive juices of the silver coatings used on candy.

FOREST SERVICE.

The notable features of the year have been the thoroughgoing attention given to improving the organization of all activities, both field and office, which has amounted to a complete overhauling of the entire administrative mechanism; better application to the National Forests of the fundamental administrative policy laid down for them by Congress, through the development of a steadily higher quality of technical work; far more effective protection of the Forests against fire than ever before; marked advance in the silvicultural work, both in connection with the cutting of timber and in the field of reforestation; inauguration of work under the Weeks Act, looking to the purchase of lands for National Forests in the White Mountains and Southern Appalachians; and, finally, but by no means least, important progress in laying broad and sure foundations, by means of thorough study of underlying technical problems, for the eventual superstructure of applied conservation, or, in other words, for development of the full latent value of the Forests as public resources. Like all foundation work, what is done in this field is mostly below the surface and attracts little public attention; but it is going quietly yet vigorously forward and is already beginning to justify itself in results. Without such work National Forest management would be a shallow-rooted plant in an arid land.

ORGANIZATION.

From top to bottom the members of the Forest Service have been studying the possibility of improving the machinery and methods in use. One reason for this has been the need everywhere felt to utilize the funds available to the best advantage. All of the various lines of work have been scrutinized in an effort to discover where more economical methods could be employed without any sacrifice of efficiency. Beneficial results have been obtained principally along three lines: First, both the scientific work and the administrative and protective work have been put on a better basis through more careful organization; secondly, the supervisory force at Washington and in the six district offices has been materially cut down; thirdly, steps have been taken to gather better cost data, establish cost standards, and insure the maximum of result in all kinds of field work, through standardizing the work itself and obtaining a measure of its efficiency.

The only important change made in the general form of organization was the creation of a new administrative unit to handle the work in connection with land purchases under the Weeks Act. It was found that the opportunity for improving the organization lay not in radical alterations of the administrative machinery, but in a tightening of the various parts and a better direction of effort. A renewed impetus has been given the scientific and cooperative work, on which largely depends the development of the practice of forestry on privately owned timberlands (carrying four-fifths of the total timber supply of the country) throughout the United States.

The organization of the work on the National Forests under six district offices, effected three years ago, had for its immediate purpose closer supervision of field activities and the elimination of delays in the transaction of business; but it had also in view the ultimate reshifting of much of the responsibility and the work then removed from Washington, out of the district offices to the Forests. To insure the application of proper technical methods and the setting of proper administrative standards, it was at first necessary to place in each district a considerable force of well-trained men. It was also necessary at the outset to provide for maintaining a considerable oversight of the district offices from the Washington office. Gradually the work of supervision both in Washington and in the districts has grown lighter, and the personnel changes thus made possible have reduced the overhead supervisory force by a third or more. A large part of these changes took place last year.

The study of costs and work standards and the effort to increase efficiency through better organization, more careful definition of the ends to be sought and the methods to be followed, and better time and output records has been taken up with enthusiasm by the rangers and supervisors as well as in the districts. Plans are being developed in many places for making the field work, and especially the work of the rangers, more effective. I believe that it would be difficult to find in any branch of the Government more energetic and loyal effort to develop and apply the methods which will mean the largest possible return in work accomplished for the money disbursed than now permeates the Forest Service.

ADMINISTRATIVE POLICY.

The act of June 4, 1897, which gave authority for the administration of the National Forests, also plainly indicated that Congress intended the reservations to be maintained, protected, and improved for the public benefit, and at the same time to be opened to use as public utilities, under regulations framed to conserve their productive value. The principal task involved in giving effect to the purpose of Congress with respect to the National Forests is that of developing their use. Their primary uses are to produce continuous supplies of timber and to regulate the flow of water. Subordinate to these uses, yet of large importance, are their use for grazing, for recreation, and for many kinds of occupancy. The regulation of use for these subordinate purposes must be so adjusted as not to prevent the carrying out of the primary purposes for which the Forests were set aside, while enabling the public to secure from them as many advantages as possible.

From the time that the National Forests were placed under my jurisdiction I have administered them with a view to the development of their largest public usefulness. Up to the time that they were taken over, little constructive work had been done. As they have been set aside in order to insure that their benefits shall be permanent, their proper development necessarily involves the making of plans which look far ahead, and such control over present use as will prevent future loss of productive power.

The object of forestry is to conserve through use. It includes protection of the timber now standing, but it has for its main purpose continued production along with constant use. Without the application of forestry, use of the Forests is always accompanied by deterioration. Forestry means simply intelligent control of the processes of nature, in order to reap the largest advantage. It is comparable with the work of scientific agriculture, of which indeed it is a branch. Just as unintelligent farming brings about a decline in the productive power of the farm, so use of forests which is not guided by knowledge of the forces at work means impoverishment of forest resources. Everywhere in this country the contact of civilized man with the forests has brought abuse of the forests. This is as true of the National Forests as it is in the East, though not to the same degree. They declined progressively from the time of the pioneers until intelligent regulation of their use began. Though vastly the greater part of the National Forests are virgin, so far as timber cutting is concerned, they have been so desolated by past fires and injurious grazing that they are in far from the best condition. One of the tasks involved in administering them is to build them up.

Technical forestry is so new a thing in this country that the nature of its work is even now not clearly understood by the public. The long period required to bring a forest crop to maturity makes the intelligent management of forests possible only if present operations are shaped with a view to results which will follow many years subsequently. The entire scheme of management generally looks to the attaining of ends a century or more in the future. It is a question of organizing all operations under a constructive plan which must move forward a step at a time, each step coordinated with those which precede and follow, to the final fulfillment of its purpose. The forest must, through scientific knowledge of the laws which govern it, be slowly shaped into conformity with the plan. The relative amounts of growing timber of different ages, the kinds of trees, the volume of timber which will be available at different times, the development of transportation facilities, and the probable future market demands, both as to quantity and kind, must be carefully calculated. All of this means that the application of forestry requires a policy of management which, for a long period of years, shall be stable. The absolute necessity for a stable policy of management constitutes the strongest reason why Government ownership of productive forests is essential to the public welfare. To develop a stable policy and attain the final goal, forest administration must be developed along technical lines.

During the nearly seven years that the Forests have been under my control I have built up a technical staff. This I regard as the fundamental achievement that has been attained. The immediate work ahead when the Forests came under my control was that of organizing an administrative system to provide for protection of the Forests, while opening them at once to as many kinds of use as possible. This immediate work, however, was undertaken with the purpose not of providing a temporary makeshift, but with an attack at once on the underlying problems of constructive development. Permanent foundations have been laid down.

The same necessity for a technical administration applies quite as strongly to the control of grazing through range management as to forest management. Unlike the National Forest timber, the National Forest range is already in practically full demand. When the Forests were created abuse of the range had gone much further than abuse of the timber. Because of the extent to which deterioration had taken place, because there was immediate demand for most of the forage, and because the forage crop is produced and harvested each year, opportunity for realizing immediate results through constructive administration was greater in the case of range management than in that of forest management. The objects sought were (1) the protection and conservative use of the range itself; (2) promotion of the best permanent welfare of the live-stock industry; and (3) protection of the settler and home builder against unfair competition in use of the range. The results which have been already obtained are a striking example of what practical conservation means. The work of the year in range management will be set forth later. I wish now, however, to call attention to the fact that all of this work has been accomplished through technical administration and could not have been accomplished without it. The technical knowledge required to handle grazing questions satisfactorily has been developed along with that required for timberland management and is applied by the same technical staff. To a large extent the two sets of problems interlock and must be handled together.

In developing technical methods of administering the Forests material assistance has been obtained by drawing on the expert knowledge possessed by various branches of the department besides the Forest Service. The Biological Survey is aiding greatly in the work of reforestation by devising methods for the control of rodents, which interfere formidably with the success of reforestation through seed sowing; is assisting in improvement of the range by the elimination of prairie dogs, which cause a heavy annual loss in the forage crop; and has contributed to the work of lessening losses to live stock through predatory animals. Protection of the Forests against destruction by insect infestations and tree diseases is in the long run fully as important a technical problem as that of protecting them against destruction by fire. In attacking it the Bureaus of Entomology and Plant Industry are contributing to the administrative work on the Forests. The Bureau of Plant Industry has also done very valuable work through studies conducted by its specialists in order to learn how the forage crop may be increased through natural revegetation of areas depleted by overgrazing and through artificial reseeding, how losses of stock from poisonous plants may be lessened, and how the carrying power of the range and the condition of the stock grazed may be improved through modifications of the methods of handling the stock. The Bureau of Animal Industry also has, in cooperation with the Forest Service, materially assisted the work of range management by checking the spread of contagious stock diseases.

FIRE PROTECTION.

In my report of last year I gave an account of the disastrous fires which took place in the summer and early fall of 1910, and discussed the means of fire protection. The final figures of losses and total area burned do not vary materially from the provisional estimates which I then gave. The fires of the calendar year 1910 covered more than 3,000,000 acres of Government timberland and 800,000 acres of private timberland within the National Forest boundaries, and inflicted damages to National Forest timber, including young growth, estimated at a little less than $25,000,000. The loss in timber destroyed or damaged was slightly over 6,500,000,000 board feet. In a single season the losses exceeded the total of all former years since Government protection of the Forests began. Compared with the calendar year 1909, the estimated money loss in 1910 was in the ratio of more than 50 to 1. In fighting the fires special expenditures were incurred totaling over $1,000,000, besides the cost in time of the regular protective force.

I pointed out a year ago that these extraordinary losses were due to unprecedentedly unfavorable weather conditions, and were, considering all the circumstances, unpreventable; but I also pointed out that they were not beyond the possibility of prevention, given the time and the means for building up a thoroughly organized protective system. Even the terrific fires of 1910 would, beyond any question at all, have inflicted enormously greater losses upon private as well as public property, and very likely much heavier losses of life, had it not been for the protective work of the Forest Service. The experience of the season of 1911 has shown that the fires of 1910 were not without their benefits. They furnished an invaluable test, under an ordeal of the utmost severity, of fire-fighting methods and needs, and also stimulated the men of the Forest Service to strain every effort in a determined attempt to prepare for the occurrence of similar conditions. By nearly doubling the appropriation for permanent improvements, Congress made available funds which were greatly needed for extending and supplementing the trail and telephone systems and for equipping lookout stations. Plans framed with a view to meeting all possible contingencies, and for coordinating all activities on the Forests in connection with the fire-protection plans, were worked out in detail during the winter. At the opening of the new fire season a notable advance had been made in the development of a more highly organized and, for the means available, efficient protective system.

The results which have been obtained are a striking evidence of the value of the preparations made. Final figures can not yet be given, but it is certain that a record has been established that surpasses anything previously achieved. While in most National Forest regions relatively favorable weather conditions prevailed, in Washington and Oregon the season was even worse than that of 1910; but the careful preparation, in the light of previous experience, made it possible both to discover fires in their incipiency and to concentrate quickly upon them a capable fire-fighting force. When the regular Forest force was insufficient to handle fires, arrangements made beforehand with settlers, lumber companies, mine operators, construction parties, and others enabled picked men to be quickly summoned. Plans for provisioning and equipping with tools fire-fighting forces and for transporting supplies and equipments from available bases to the men on the fire line were carefully worked out. In short, the object aimed at was that nothing should be left to chance or extemporized effort in the face of an emergency. The localities exposed to greatest danger, either because of the existence of conditions creating a special risk of the outbreak of fires or because the damage, should they gain headway, would be particularly severe, had been ascertained and received special protection. Patrol of the Forests was organized and distributed with a view to obtaining the largest possible efficiency, and the construction of telephone lines and trails was pushed where they were most needed. Lookout points and watch towers, connected by telephone with the headquarters of each Forest, were located in commanding positions and proved of invaluable assistance in the prompt discovery, precise location, and swift reaching of fires. As a result of these careful preparations the fire damage was greatly reduced. The fund of $1,000,000 made available by Congress in case of extraordinary emergency was drawn upon only to the extent of a few thousand dollars. In district 4 the total extra charges incurred for fighting fires amounted to less than $3,200; in 1911 the corresponding cost was $56,000. On the only Forest in this district for which figures of loss this year have reached me, 42 fires have occasioned an estimated loss of $30, where in 1910, 17 fires occasioned a loss estimated at $151,500.

While the results of the past summer are gratifying, it must not be assumed that the protective organization is yet able to cope successfully with a repetition of the climatic conditions which occurred in 1910. The inadequacy of the system of communication is its greatest weakness. There have been completed on the National Forests the equivalent of 1.29 miles of trail and 1.04 miles of telephone line to each township of 36 square miles. This means that if all the trails were laid off on straight lines running parallel to each other, without detours or cross connections, they would still be about 28 miles apart, while the telephone lines if similarly located would be 35 miles apart. Of course the system of communications built by the Forest Service is supplemented by roads, trails, and telephone lines which are the result of community and private enterprise; but the fact remains that great parts of the National Forests are most indifferently provided with improvements. Ten miles of trail and six of telephone line in the average township represent the approximate system needed for efficient protection. The construction of about eight times the present mileage of telephone line is therefore necessary to safeguard the National Forests adequately.

A remarkable development of public sentiment regarding forest fires has taken place. In this field, also, the fires of 1910 proved a great lesson. Belief on the part of a portion of the public that forest fires are either inevitable or of little importance has been replaced by a keen realization of the necessity for adopting safeguards against them and for putting them out. One result of this awakened and healthy sentiment has been more exacting demand for a high standard of protection of the National Forests. Fires which would previously have attracted little or no attention now receive wide newspaper notice and comment. The gain along this line has been enormous. It means, of course, public criticism if fires are not effectively controlled; nor is this a misfortune, for a public demand that a high standard of administration shall be maintained is in itself a safeguard; but it means also diminution of carelessness, better laws, and more general efforts to combat forest fires everywhere.

The growth of sentiment is reflected in the increased desire on the part of timberland owners, railroads, and business enterprises of all kinds conducting operations on or near the Forests to cooperate with the Forest Service in fire protection. The efforts of the railroads which run through the Forests to reduce to a minimum the danger of fires along their lines, through clearing their rights of way, preventing the discharge of sparks and the dropping of live coals, and cooperation in patrol of the lines and the reporting of all fires discovered, deserve special mention, and the same is true of the increasing desire of timberland owners to provide systematic protection of their extensive holdings. Where these holdings are either adjacent to or intermingled with National Forest land in such a way as to make a common system of protection advantageous to both parties, the Forest Service and the associations have joined forces.

FOREST MANAGEMENT.

There was cut on the National Forests during the year a total of almost 500,000,000 board feet of timber, of which about 375,000,000 feet was sold and over 123,000,000 feet cut under free use. The total value of the timber cut under sales was $843,000, a decrease of $63,000 from the previous year. The contracts of sale entered into during the year, however, disposed of over $2,000,000 worth of timber—an increase of 50 per cent over the corresponding amount for the previous year. The average stumpage price obtained for the timber sold was $2.56, as against $2.44 in 1910.

It is estimated that the annual cut which might be obtained from the National Forests without diminishing the available supply (since the increase by growth would offset it) is over 3,250,000,000 feet, or more than six times what was cut. The Forests are now a heavy charge on the Government, and much of the timber is overmature. A natural question is: Why are not the sales increased, at least to the point at which the Forests will pay their way?

The answer is readily given. Since the panic of 1907 the lumber market has been depressed. During the past year there has been overproduction in the Northwest, where the heaviest stands of National Forest timber are found. To obtain any great increase in the receipts from timber sales last year I should have had to offer the timber at a price far below its actual value. The public is now amply supplied. Within a relatively few years the timber on the National Forests will be in great demand to meet fast-growing necessities and to help develop the West. I should be utterly disregardful of my responsibility and duty to the public, which owns the timber, if I were to permit large amounts to be needlessly sold on bargain-day terms, and with the knowledge that instead of promoting the conservation of our timber resources I am accelerating their waste.

Vigorous efforts to dispose of at least a considerable fraction of the timber killed in last year's fires culminated after the close of the fiscal year in several large sales, aggregating about 290,000,000 feet. It is hoped to be able to sell perhaps 1,000,000,000 of the estimated 6,000,000,000 feet of dead timber which formed the aftermath of these fires; the remainder is too remote from present demands to be lumbered. The effort to sell this timber did not consist merely in making known the fact that it was for sale and offering it at a low price. Almost before the fires had ceased to smoke preparations had begun for cruising the timber in order that full data might be available for prospective purchasers. By being able to tell interested lumbermen what quantities of timber were obtainable on specific logging units, what development of transportation facilities would be required, and what logging methods could be employed, sales were facilitated. The same method is being extensively practiced for sales of live timber. Reconnoissance parties are put in the field to secure detailed timber estimates and make accurate maps, thus obtaining data valuable both for devising a long-term plan of management and for making immediate sales; intensive reconnoissance studies have now covered nearly 9,000,000 acres, of which nearly 4,000,000 acres were covered last year. Less intensive reconnoissance has covered an additional 17,000,000 acres.

On the basis of the best information in hand, I fix each year a maximum cut to be allowed during the year, usually for each Forest, but sometimes for groups of Forests so situated that from the standpoint of sustained yield they may be treated as a single unit without jeopardizing the future supply of timber for local use. This maximum cut is prescribed in order to prevent overcutting—that is, the removal of more timber than the current production through growth. The maximum cut authorized from all Forests during 1911 was a little less than 3,300,000,000 board feet. All sales are made with primary consideration for developing the productive power of the Forests through utilizing material whose removal will either be followed by the establishment of a new crop or increase the growth of the part of the stand left or both together. Merchantable dead timber and overripe timber, which is declining in quantity and value through decay, are being disposed of wherever a market is open. Under the silvicultural methods which are being applied steady increase in the rate of annual growth will be secured for many years.

Out of a total of 5,653 separate sales made during the year, 5,144 were for less than $100 worth of timber each, 397 for from $100 to $1,000 worth, and only 39 for over $5,000 worth. These figures show the extent to which the National Forests are drawn upon for the supply of small local demands. It is evident, however, that, along with continued use of the Forests for meeting local needs through small sales, a wise public policy demands the making of sales to large purchasers who will operate through a term of years, in Forests too far removed from present markets to permit of utilization in the near future without heavy investments of capital for means of transportation to get the timber out. Prior to the year 1911 no contracts were made for operations to cover a longer period than five years. Last year, however, three sales were advertised on terms which contemplated operations extending over from 7 to 10 years. It will be my policy, as favorable opportunity offers, to sell a certain amount of timber under longer-term contracts than have prevailed in the past, but with provision for the readjustment of stumpage prices at regular intervals and with proper precautions against purchases made with a view to reaping a speculative profit. Such sales will not only make it possible to utilize timber now ripe for the ax and thereby to increase the productivity of the Forests, but will also make it possible to advance with fair rapidity toward the point at which a sufficient income will be obtained to make the Forests self-supporting. The marked increase in the volume of sales last year, previously noted, is an indication of progress already making in this direction. On a number of Forests on which demand for timber is active the receipts from timber sales show even at the present time a net revenue over the cost of administration.

REFORESTATION.

The problem of reforestation concerns both the establishment of new growth after lumbering operations and the extension of the forest over denuded areas. In either case there is a choice of methods. Reforestation may be accomplished, and is actually being accomplished on a very large scale, by making the forests themselves do the work. It is also accomplished through artificial methods.

The most valuable tool, under present conditions, for renewing and extending forest growth is fire protection. There are about 15,000,000 acres of denuded lands within the National Forests, the result of old fires and unregulated grazing. To a large extent these areas are now practically unproductive barrens, though some of them have a certain value as inferior grazing lands. In addition, some 90,000 acres are cut over annually under National Forest timber sales; and there is a further area, large in the aggregate, of grass lands, much of which will eventually be covered with growing timber. On all of the land which is now being cut over the operations are planned with a view to securing natural reforestation. It is estimated that an additional 150,000 acres of denuded land are being reoccupied by forest growth through natural extension. In both cases the desired results depend absolutely on keeping out fires, supplemented on a large part of the areas involved by the control of grazing. In other words, over 250,000 acres are being reforested annually by creating conditions favorable to natural reproduction.

It is probable that half the denuded lands, amounting to about 7,500,000 acres, will eventually be reconquered by the forest without the employment of other agencies than the control of fires and the regulation of use. At the estimated present rate of forest extension it will take about 50 years to complete the process. Artificial reforestation must be employed on the other half, and will doubtless also be employed to some extent, as the need for timber supplies grows more pressing, to hasten the process of natural forest extension. It may also be called for as the best means of reestablishing the forest after lumbering on certain classes of cut-over lands.

The object sought in reforestation is not only the production of timber for cutting, but also the improvement of stream-flow conditions.

The work of the year in artificial reforestation included both seed sowing and tree planting. The seed sowing was applied on a little more than 23,000 acres under a variety of methods. The tree planting was applied on 2,000 acres with the use of nursery stock grown in nurseries on the National Forests. Aside from the stock furnished without charge to settlers in western Nebraska under the Kincaid Act, the annual product of these nurseries will within three years be sufficient, after providing for losses incident to the various stages in the development of hardy seedlings, to plant 8,000 acres annually.

On most of the National Forest areas which are in the greatest need of artificial reforestation the work is exceptionally difficult. Where the natural conditions are favorable, the Forests tend to restore themselves. Success in establishing a new forest growth under semiarid conditions depends on the discovery of methods based on careful experiment, and even so must always involve a certain element of luck, due to the vicissitudes of seasonal variations. In a certain sense, almost all of the work hitherto done is to be regarded as experimental; that is, it is the process of working out commercial methods rather than the application of methods which have been reduced to a strictly business basis. The practical expediency of reforesting any area as a wise business policy could be decided only by balancing the probable cost against the probable benefits; this would require a reasonably accurate estimate of the cost. The object of the work which has been actually undertaken has been rather to find out what the cost will be and to test the relative cost and success of different methods. Considered as a business operation, the average cost has been high and the variation in cost has been extreme. The practical value of the work lies in this very fact, for results are being secured in the light of which future operations may be directed along the best and most economical lines.

In regions where the conditions are relatively favorable, as on the west slopes of the Rocky Mountain and Cascade Ranges in the Northwest, the results obtained justify operations upon a larger scale than in the past, although there is still need for intensive work with investigation as its prime purpose. From the standpoint of obtaining a maximum return from the expenditure involved much further study is needed. Nevertheless, the knowledge already obtained justifies making a considerable start upon the actual work of reforesting portions of the great area of denuded lands. As sufficiently conclusive experimental results are secured the work will be extended into new regions.

One field in particular calls for early action. The watersheds of certain streams used for municipal supplies or for irrigation are in urgent need of improvement by the establishing of a forest cover at the earliest possible time. While it would be improper to expend large sums in attempting reforestation, even on such watersheds, before methods known to be successful have been worked out, immediate attention can be given to the betterment of a number of important municipal and irrigation water supplies. This work has already been entered upon.

The cost of the seed, nursery stock, equipment, and labor required to reforest the 25,000 acres covered last year was about $134,000. The Forest Service is now prepared to reforest 30,000 acres annually, without asking any increase of its total appropriation. To divert from other lines, which are essential for proper protection of the Forests, and for enabling the public to use them, funds which would provide for a greater extension of the work of reforestation would, in my judgment, not be justifiable under present conditions.

Certain important facts have been discovered concerning the relative merits of different methods. The success of direct seeding in all regions in which the supply of soil moisture is not fairly good must be regarded as at the best problematic, but reasonably good results have been obtained in planting nursery stock in some of the drier regions. The use of European seed appears inadvisable, though it can be bought at a lower cost than that involved in collecting western seed. About 53,000 pounds of coniferous seed was collected by the Forest Service, at an average cost of $1.24 per pound, while about 27,000 pounds was bought at an average cost of 78 cents per pound. Devices have been developed for extracting and cleaning seed by machinery at extracting plants located at central points, to which the cones can be sent. The cost of collecting seed has been found to vary widely, depending principally upon the abundance of the seed crop, and it will be the policy in future to gather large quantities of seed in years when the crop is abundant, spending much of the money available for reforestation in such years in obtaining seed for use in following years. As a result of the study of the effects of storage it is now certain that seed can be carried over from one season to another with slight loss of fertility. The problem of preventing the failure of seeding operations through the work of rodents, studied with the aid of the Bureau of Biological Survey, gives promise of successful solution. Broadcast seeding on unprepared ground, though altogether the cheapest method from the standpoint of labor cost, has been found to be in the long run the most expensive and the least satisfactory method, both because of the relatively large amount of seed required and because the seed seldom finds the conditions required for germination and the establishment of the young plant. As a rule sowing in the fall has been found better than winter or spring sowing, since it secures earlier and, with many species, much more uniform and complete germination. In some localities, however, the contrary is true. The average cost of seeding in the larger administrative units varied from $2.35 to $6.95 per acre. Marked progress was made in reducing the cost of nursery-grown stock, and it is believed that 2-year-old seedlings can soon be produced for not over $1 per thousand plants and 2-year-old transplants for not over $2 per thousand. One-year-old seedlings were grown in Washington at 37½ cents per thousand, exclusive of the cost of equipment, but a large part of the stock used in planting during the year cost from $8 to $12 per thousand. The experimental work was exceedingly varied, including many kinds of hardwoods and the widest range of localities, conditions, and methods.

GRAZING ON THE NATIONAL FORESTS.

Both the number of animals grazed on the National Forests and the receipts from grazing were less in the fiscal year 1911 than in 1910; the paid grazing permits issued covered about 1,352,000 cattle, 92,000 horses, 4,500 hogs, 7,372,000 sheep, and 78,000 goats. The amount received from grazing was $935,490.38, which is $51,419 less than last year.

The falling off in the total number of stock grazed was due not only to the reduction in the amount of the range available through eliminations of land from the Forests, but also to general conditions affecting the stock industry. The grazing season of the calendar year 1910 was one of abnormal scarcity of feed and water because of the prolonged drought. The forage crop was estimated at from 25 to 33 per cent below normal, and matured very early. Nevertheless, the stock grazed on the National Forests passed through the season without severe losses and left the Forest ranges in better condition than had generally been expected. High market prices for cattle, however, combined with scarcity of feed on the winter ranges and of hay, together with the belief among sheep owners that the immediate outlook for their industry was not favorable, caused large reductions in the number of stock carried through the winter. In consequence the demand for range for the season of 1911 was decidedly less than the year previously.

The capacity of the range for the grazing season of 1911 was, except for the effect of the eliminations made from the Forests, above that of previous years. Favorable weather conditions resulted in an exceptionally heavy production of forage. The two unfavorable preceding years had put the range to a severe test, but the effects of the regulation of grazing in order to prevent impairment of productive power, and of the development work which has increased the area of available range and the supplies of water for stock, had borne good fruit. On seven Forests considerable reductions in the number of stock which it was considered advisable to admit had been decided upon; but the increases made on other Forests more than offset these reductions, so that had it not been for the decreased demand for the grazing privilege due to general conditions affecting the stock industry, and the elimination of large areas having a high grazing value, the grazing use of the Forests during the year would have exceeded that of 1910.

It is also to be noted that, both in the case of cattle and horses and in that of sheep and goats, the number of permits issued to small owners was greater than in 1910. The total number of permits issued in 1911 was 25,604, as against 25,687 in 1910; but the number of cattle and horse permits for less than 40 head, and the number of sheep and goat permits for less than 2,500 head, showed an increase.

There has been a tendency on the part of some of the associations of stockmen formed to cooperate with the Forest Service in the adjustment of use of the range to become disorganized because the immediate grazing problems have been worked out to so satisfactory a conclusion that there seems little to hold the associations together. While it is a cause for gratification that the relations of the Forest Service with the stockmen have become so satisfactory, the opportunities for helpfulness to the stock industry in developing better methods of range utilization are such that continued cooperative work is highly desirable, and it is to be hoped that the associations of stockmen will be maintained to further this work. The number of associations now cooperating with the Forest Service is 68.

As a result of the work of the Bureau of Animal Industry in cooperation with the Forest Service, all but three of the National Forests are free from communicable diseases of live stock. Protective measures were necessary to prevent the spread of scabies, lip-and-leg disease, and Texas fever. About 8,000 predatory animals were destroyed by employees of the Forest Service during the year. The number of most kinds of animals killed was less than in 1910, indicating that the work of past years has had its effect in reducing the number of animals which infest the National Forest and adjacent ranges; of grown wolves, however, there were killed 25 per cent more than in 1910. The work of freeing the ranges from prairie dogs was carried on by the Forest Service for a part of the year and then taken over by the Biological Survey; on the areas which have been treated the infestation has been greatly reduced. The losses of live stock from poisonous plants were reduced to a negligible point. The Bureau of Plant Industry rendered indispensable assistance in this work, as also in the study of the very important technical questions involved in the effort to improve the condition of depleted portions of the range.

A work of great importance to the development of use of the range to its highest point was inaugurated in the form of plans for technical reconnoissance on all the National Forests suitable for grazing use, with the object of gathering exact data on all matters which affect range management and the production of the forage crop. This work will ascertain the character of all land within the Forests, the kind of stock to which each natural grazing unit is best adapted, the natural periods of use, the undergrazed, fully grazed, and overgrazed ranges, and localities in which poisonous plants and range-destroying rodents are found.

Striking results were obtained in an experimental test of a system of inclosures for lambing pastures, designed to decrease losses and lessen injury to the range, and in continuation of the coyote-proof pasture experiment.

APPALACHIAN WORK.

The act of March 1, 1911, commonly known as the Weeks Act, made available for examining and purchasing forest lands in the White Mountains and Southern Appalachians before the close of the fiscal year 1911 the sum of $2,000,000. By the provisions of this act I was authorized and directed to examine, locate, and recommend for purchase lands in my judgment necessary to the regulation of navigable streams. Approval of all purchases was vested in a commission of seven, created by the act; but purchases were to be made only after field examinations by the Geological Survey had established that control of the lands would promote or protect the navigation of streams. It was provided that I should serve upon the commission, and should purchase, in the name of the United States, lands which the commission had passed upon favorably.

Immediately upon the passage of the act I instructed the Forester to organize and press forward the work of land examination. Field information previously gathered made it possible to select at once a number of specific areas within which the purchase of lands was desirable. Proposals for the sale of lands within these areas were invited on March 27. At the close of the fiscal year, on June 30, proposals covering over 1,250,000 acres had been received, over 170,000 acres had been examined, and the purchase of 31,377 acres had been authorized. The fiscal year 1912 opened with 35 examiners at work, and with every indication that during the year land enough will have been covered to afford a basis for recommendations of purchase up to the limit of the $2,000,000 appropriation made available by the law.

INVESTIGATIONS.

Much of the investigative work of the Forest Service has already been touched upon in describing the administrative work, particularly as regards the study of problems which relate to forest management (including reforestation) and range management on the National Forests. The timber and range reconnoissances which are being carried forward on an extensive scale are investigations to obtain data indispensable for the intelligent utilization and conservation of the productive power of the Forests. Besides the studies of methods of direct seeding, nursery practice, and field planting, which have formed a large part of the reforestation work, the subjects of seed production, seed fertility, methods of storage, and heredity of desirable and undesirable qualities have been under investigation, as well as that of the effect upon reproduction of different methods of disposing of slash, and of different methods of grazing control. At the three forest experiment stations which have been established in Colorado and Arizona, careful studies of forest influences, including the effects of forests upon stream flow, and of climatic requirements of different forest types have been conducted. Research work in forestry is just as essential to securing the best use of our forest lands as is research work in other branches of scientific agriculture to the best use of our farm lands. Unless this work is prosecuted vigorously and along many lines, progress in developing better methods of handling the Forests will be severely handicapped. It has been necessary, however, to reduce the investigative work to a minimum during the year in order to provide for the immediately pressing necessities of protection and use. The present appropriation compels curtailment of activities along all other lines in the effort to keep fires down and transact current business. That is, to a certain extent, a sacrifice of future to present welfare is a fact which must be frankly recognized.

Forest investigations are also conducted in the interest of improved use of the forest resources of the country which are in private ownership and to aid the various States in inaugurating and developing wise forest policies. Forest studies conducted with these ends in view were continued in all parts of the country. Effort was especially directed toward the promotion of practical forestry among farmers, who own in the aggregate so considerable a part of our timber-growing land. From the fact that the farmer's woodlot constitutes a permanent holding, drawn upon steadily for wood supplies, the practice of forestry can probably be more easily introduced on the woodlot than on the large holdings of lumbermen, whose operations are seldom planned with a view to holding the land permanently for forest purposes.

A very important part of the investigative work is that which relates to the study of forest products. The major part of this work is conducted in the Forest Products Laboratory at Madison, Wis. It includes studies in the physical properties of wood, the drying of wood, strength tests, wood preservation, wood distillation, the production of wood pulp and paper and of naval stores, and wood utilization. Many of these studies are highly technical, but all are thoroughly practical in their aim. The facilities for scientific research in the field of forest products are now adequate, and the work is well organized and conducted by a corps of trained specialists. Results are being attained which mean a lessened drain upon our forest supplies through more economical use of material, the opening of new sources of supply for various industries, the utilization of every kind of wood for the purpose to which its intrinsic qualities best adapt it, a greater incentive to the practice of forestry because of the increased returns made possible, better adjustment of wood-using industries to meet the conditions created by past use without forethought, and a general clarifying of the situation with respect to our forest resources and requirements through accurate knowledge of what these requirements are and what is available to fill them.

BUREAU OF SOILS.

SOIL SURVEY.

Soil surveys were carried on in 60 areas distributed through 21 States, and a total area of 95,420 square miles was mapped. Of this area, 25,096 square miles were mapped in detail and 70,324 square miles were mapped in the broader, more general way, which we designate as reconnoissance mapping.

The demand for surveys continues to run far ahead of our ability to do the work. An increasing interest in the work is being manifested by agricultural colleges and experiment stations. They are beginning to use the results of the work as a basis for their experiments as well as their demonstration and extension work. The lack of such a demand in the past has been due to a recognition of the futility of the demand if it were made. Soil surveys had not, until very recently, covered an area in any State sufficiently large to enable investigators to draw any general conclusions from them or to base on them any comprehensive scheme of investigations. This is no longer the case. In a few States as much as half the area has been mapped, and in many others from a fourth to a third has been covered. Owing to the policy of the survey of distributing the work rather uniformly over the whole area of the various States, even the mapping of a fourth of the total area will enable an investigator or a student of the maps to arrive at a close approximation to the distribution over the State of the main soil areas, such as the soil series, at least.

Until considerable areas had been covered wholly or in such a way that approximate conclusions could be drawn as to the conditions in such areas, our results could not come into general use. Not only could they not be used for the reasons stated above, but they were not even well known; not enough had been done to attract attention. A certain amount of passive or active opposition, due in many cases merely to lack of familiarity with such work, its methods, nomenclature, and results, manifested itself during the early years of the bureau's activity. The time has come when the work is forcing its way to recognition by its quantity, even if it be not by its quality. The mere mass of the work already accomplished is making it evident that it has already gone so far that to recede is impossible. It is evident also that the general plan of the work can not be profoundly changed, thereby causing those whose objections to the work were based on its methods and its system of expressing its results to realize that such objections must now be futile. There is no such thing as an absolutely right way to do work of this character. There are various methods and various points of view. One method or system must be adopted and one point of view must be maintained if the results are to have any consistency or any value. It is not so important which system is adopted or what point of view is maintained as it is to be consistent after some one system has been adopted.

The work of the soil survey is no longer new and unfamiliar. Because of increasing familiarity with it investigators find less occasion to criticize it or ignore it. By many, if not most, of the broadest men in the agricultural colleges and experiment stations of the country the necessity of a soil survey on which to base investigations is admitted without question. That the idea will spread still further can no longer admit of a doubt.

This increasing recognition and interest in soil survey work is expressing itself in increasing requests for cooperation, made by State organizations. We have been compelled to decline many such requests solely because of lack of funds. Cooperation with a State organization makes it necessary for us to do more work and spend, therefore, more money in that State than might be done without cooperation. In declining requests for cooperation, however, we have not changed our opinion as to the value of cooperative work. Work done under such conditions is considered to be often of a higher grade than that done without cooperation. It brings together and harmonizes the experience of two organizations, each, because of the conditions of its existence, possessing knowledge that the other does not possess. It increases also the total amount of work done by the amount that the

State men are able to do. It is very desirable that the Bureau of Soils be placed in a condition enabling it to take up cooperative work with all the States that desire it. This will avoid the inevitable confusion that would result if the States should do the work alone and according to any point of view they might have. The increasing interest in the work is making it certain that the States will undertake it alone if the bureau can not lend its aid in the matter. For the sake of fullness, accuracy, and uniformity of results it is very important that the bureau should be placed in a position where it would not be compelled to decline requests for cooperation.

Another condition arising from the increased interest and recognition of the work of the soil survey is the necessity for greater accuracy, not only of mapping, but of definition and correlation. This necessitates more careful supervision of the field work, more comprehensive study of soil relations, and more careful criticism of reports and maps by the scientific staff of the survey. During the past year more time has been spent in this part of the work than has ever been spent in this way before. The results have fully justified the money and effort expended. Rigid supervision is absolutely necessary if uniformity of results is to be attained. The increased supervision has not, however, sensibly increased the cost, per square mile, of the work. The membership of the supervising staff has not been increased, in fact there has been a slight decrease, but the better results are being brought about by greater care in the work and better methods. Revolutionary or striking results have not been attained and are not expected in the future. Soil survey work is fundamental in its nature. In the very nature of the case it can not be spectacular. The soil survey is an institution devoted to the accumulation of a well-defined group of facts. The knowledge thus gained has a scientific as well as a practical value. The practical knowledge can be applied in many cases at once and valuable economic and social results arise from it. This is the value that is usually emphasized—to be able to direct agricultural progress along proper lines, to point out natural adaptabilities of soil, to suggest improved methods of cultivation based on a knowledge of the soil to be cultivated, merely to attract the cultivator's attention to the soil as something well worth his careful study; these are some of the possibilities and actualities of the soil survey. The fact, however, that its results have a practical value of this kind makes them no less valuable as facts of science.

A careful survey of the natural resources of a state or a nation is essential to the inauguration of a systematic plan for utilizing or developing them. This has long been recognized in theory, but has been strangely limited in its application. Geological surveys were inaugurated by many States more than half a century ago and by the Nation many years ago. Forest surveys also were begun in a very general way by some of the States many years ago. A survey of the soils of any part of the country, however, seems not to have been seriously thought of until little more than a decade ago, yet the natural resources of the soil are of more importance to the welfare of mankind than all other natural resources combined.

SOIL-FERTILITY INVESTIGATIONS.

The work on the problems connected with the fertility of soils has opened up avenues of profitable investigation and already forecasted results of great economic importance. The investigations have been made on soil from various parts of the United States, comprising a number of important soil problems. During the year these researches have led to the discovery of organic soil constituents decidedly beneficial to growing crops. These are organic nitrogen compounds, and it has been demonstrated that they exist in organic fertilizers, in green manures, and in soils; that they are directly beneficial to crops, and that they are able to replace nitrates in aiding plant growth. The facts demonstrated by these investigations are of fundamental significance in soil fertility, and the recognition of these directly beneficial soil constituents is no less important than the recognition that harmful soil constituents exist.

The effect of harmful soil constituents and their distribution in the soils of the United States has been further investigated. The presence of one of these harmful constituents has been definitely associated with poor yield on many soils from all parts of the United States from Maine to Texas and Oregon. The compound is therefore of common occurrence and is likely to be encountered in soils where unfavorable conditions exist which tend to form and accumulate this constituent.

The nature of soil humus has been further investigated and a considerable number of new constituents determined, among them organic compounds containing nitrogen and phosphorus. The nitrogen and phosphorus are frequently tied up in the soil in very resistant forms in complex compounds which have been isolated. To be utilizable by plants this complex must be broken up, and this phase of the question has already been studied with considerable success. The chief aim in the agricultural use of nitrogen is to convert this into nitrates by chemical and biological means, an operation which is far from simple. The present researches are very suggestive of the fact that for agricultural purposes it may not be necessary to convert all nitrogen into nitrates, but that nitrogen of waste nitrogenous materials in the industries can be converted into compounds of the nature of the beneficial soil constituents discovered in this work, and so make available to agriculture much nitrogen now lost because of the difficulty of converting it into nitrates.

FERTILIZER RESOURCES.

The management of the soil for the efficient and economic production of crops is the fundamental problem of agriculture. In general, three instrumentalities are available, namely, tillage, crop rotation, and fertilizers. And the history of the world shows that as the civilization of a region advances intensive methods of cultivation replace the extensive methods of the pioneer, and all three instrumentalities must be employed that the land may be brought to and maintained at a high productivity.

Tillage and crop rotation problems are very largely within the personal control of the farmer himself. Fertilizers, however, involve contact with outside commercial and manufacturing interests, so that they invite the special aid of the Government. Two great problems are presented, (1) to find sources of fertilizer materials, and point out methods and agencies for the preparation of the material to the use of the farmer, and (2) to bring the people to a realization of the value of properly used fertilizers. To both of these problems this department is addressing itself assiduously. To further the efforts of the department, especially in meeting the demands of the first problem, Congress at its last regular session made a special appropriation, directing that the Bureau of Soils should explore and investigate natural sources of fertilizer materials. Although less than half the fiscal year has expired since this appropriation became available, the results accomplished are of a character to justify special comment at this time.

Phosphatic fertilizers have been studied, the areas of productive rock at present and prospectively available have been noted, and valuable information has been gathered regarding improvements in methods of saving waste at the mine and in the manufacture and distribution or sale of product. It seems that new occurrences of natural deposits of phosphates are being continually reported and that the amount of such material now known to exist in this country is so vast as to dissipate any fears as to our natural resources in this regard. At the same time, for many reasons, improvements in methods of mining and utilizing this great resource are imperatively demanded in the people's interest, and we have called attention to these matters in appropriate publications from this department.

Among the various sources of nitrogen fertilizers, possible deposits of nitrates in the arid and semiarid areas of the country have long held a prominent place in the scientific and popular mind. Our people have observed and studied some deposits of this character. Generally, however, these deposits are either too small in amount to justify commercial exploitation or they are inaccessible to transportation or available water for working them, or are otherwise of doubtful economic importance. There is no available experience in this country to guide our people in working such deposits, the conditions surrounding them being essentially different from those in other countries.

Whether or not natural deposits of nitrates can be commercially exploited is yet an open question, but it is a distinct advance to know that such deposits exist. Various other sources of nitrogenous fertilizers have also been investigated, and it is especially worth noting that there is a well-defined tendency in our main coking regions to introduce modern ovens and make available large quantities of ammonia, which have generally been discarded until very recently.

Especial interest attaches to the work on potash fertilizers, because commercial sources of potash have been unknown in this country, the world's supply in fact coming from the Stassfurt deposits in Germany. The advantage of having a domestic source is so obvious as to require no comment. Possible sources of potash are by no means few. Much potash can be recovered from the immense accumulations of sawdust in our lumbering regions, from the vinasses in our sugar mills, from wool washings, etc. Possible sources of potash include also the bitterns or mother liquors from our salt workings. These are now under investigation. Segregated deposits of potash salts may lie under our known salt deposits, or below the present surface in desiccated sea or lake beds. This is now being investigated. The desert basins are being explored by our agents for surface deposits of potash, as well as nitrates.

The utilization of natural potash-bearing silicates has long attracted investigators and inventors. Vast deposits of potash feldspars, glauconite, leucite, and other suitable minerals exist in this country, and our laboratories as well as private parties are now actively at work on methods for extracting the potash. The extraction of potash in various ways is perfectly feasible in the laboratory. But the energy required to break down the chemical combinations and extract the potassium is so large as to make its production inhibitive at the present time. Extremely cheap power or the incidental production of valuable by-products might possibly make the potash silicates commercially available.

There is, however, one mineral which occurs in large quantities and which offers some hope of becoming a commercial source of potash. This is the basic alumino-potassic sulphate known as alunite. From it potash alum (known commercially as Roman alum) has long been made in Europe. Our people have shown that potash can be readily obtained from the mineral, and, by special devices which they are studying, probably other by-products can be obtained which will greatly cheapen the cost of the potash.

The most promising source of potash at present is found in the large areas of kelp groves or sea algæ lying along the Pacific coast, growing wherever there is a rocky bottom and a rapid tideway, or beyond the surf line, at depths of from 6 to 10 fathoms. These groves are of various areas from beds of a fraction of an acre to stretches 5 miles in length and 2 or more miles in width. During the past summer our people have mapped about 100 square miles of kelp groves in different localities from Puget Sound to Point Loma and have studied the character of the algæ as well as the conditions necessary to their utilization commercially and to their maintenance as a permanent resource of the country. Many more areas yet remain to be studied and mapped, but from what has been accomplished in this preliminary work I am assured that a conservative estimate shows that the kelp which could be gathered from the 100 square miles already surveyed, and without detriment to the permanence of the groves, should yield 1,000,000 tons of chloride of potash annually, worth at least $35,000,000, or about thrice the value of the present importations of potash salts from Germany.

Satisfactory methods of gathering the kelp are yet to be worked out, but present only minor mechanical difficulties. The value of the kelp is, moreover, probably much greater than represented by the content of potash alone. Our laboratories have shown that iodine and other useful products can be obtained which will pay in large measure, if not fully, for the cost of gathering the kelp and abstracting the potash salts.

Enough has been accomplished to show that this country has within its own borders resources to meet the fertilizer requirements of the present, and for a greatly increased use in the coming years. The saving to our people which can reasonably be expected from these investigations is enormously greater than the cost. These investigations are, however, but little more than begun, although begun very well. That they should be liberally supported and actively prosecuted can admit of no possible argument. Economic independence of outside nations with large financial gain to the public at the same time is a desideratum justifying the utmost effort of our scientific investigators and strong sympathy and aid from the people's representatives.

BUREAU OF ENTOMOLOGY.

The work of the Bureau of Entomology covers the whole field of the economic aspect of the work of insects, whether they are injurious to agriculture or horticulture or to domestic animals or man, or whether they are beneficial in one way or another. Only a few of the numerous investigations carried on under this bureau can be mentioned here.

WORK ON THE GIPSY MOTH AND THE BROWN-TAIL MOTH.

The general conditions in that portion of the country originally invaded by the gipsy moth, that is to say, eastern Massachusetts, have been better during the past year than for many previous years. This has been due in part to weather conditions, to the prevalence of the wilt disease, to the gradual increase of parasites imported from abroad, and to the cumulative effect of the excellent work done along roadsides by the Bureau of Entomology, in certain forests by the State of Massachusetts, and in the different towns under municipal and State control. The conditions in New Hampshire, however, are much worse than in Massachusetts. Many towns in the southeastern part of the State are seriously infested, and the insect occurs in 125 towns in all. In several of the northern towns the pest has apparently been exterminated. In Maine there has been a further spread, and a new colony has been found in Rhode Island. The brown-tail moth has established itself in the northeastern part of Connecticut.

The increase and spread of the imported parasites and natural enemies of both the gipsy moth and the brown-tail moth has been gratifying, and several species have been brought in during the past year in large numbers which the Bureau of Entomology had not previously been able to secure. During the summer an imported Japanese egg parasite, which had previously been thought to have died out, was recovered in considerable numbers. An appreciable effect upon the numbers of the gipsy moth as the result of parasitic work is beginning to be noticed.

New studies have been begun of the feeding habits of the newly hatched caterpillars of the gipsy moth, and already it seems that it will probably be possible to control the gipsy moth in forested areas by a certain variation in forest management dependent upon the feeding habits of the young caterpillars. This means that the forests of New England, and later other portions of the country, are not doomed, and that a good stand of timber can be maintained even should the pest increase beyond the ultimate control of the parasites, and this in itself is most unlikely. It appears, in fact, that the number of species of forest trees upon which the young gipsy moth larvæ can feed and maintain themselves until they reach a considerable size is very limited.

THE ALFALFA WEEVIL.

The situation regarding the alfalfa weevil, an insect obviously imported from Europe, and which became established in the vicinity of Salt Lake City, Utah, is continuing to become more serious and alarming. The last Congress made immediately available $10,000 for an investigation of the pest. Experts of the Bureau of Entomology, working in cooperation with the Utah Agricultural Experiment Station, have traced the spread of the insect from Salt Lake City south to Springville and north to Ogden, west to beyond Tooele and east to Wyoming. Judging from what has been observed between Salt Lake City and Ogden, and between Ogden and Brigham, the uniform normal spread of the pest is about 30 miles a year, though circumstances may greatly change this. Many experiments have been carried out with mechanical devices for destroying the pest in infested alfalfa fields and thereby protecting the second and third crops. An investigation was made of the parasites of this weevil in Italy, and during March and April last large lots of the stems of alfalfa containing eggs parasitized by a minute parasite were sent to Salt Lake City, arriving there in good condition and the parasites emerging in numbers. Three other parasites were sent over later, and an attempt is now being made by agents of the bureau to establish them in the Utah alfalfa fields.

WORK IN THE ORANGE AND LEMON GROVES OF CALIFORNIA AND FLORIDA.

In my last report I mentioned the completion of the study of the problem of hydrocyanic-acid gas fumigation in California, directed against certain scale insects on citrus trees, and stated that the careful experimental work carried on had resulted in a great reduction in the cost of fumigating, since one treatment under the new methods was as lasting in its effects as three or four distinct treatments under old commercial methods. Observations during the past year have shown that this was an underestimate, and that an orchard once fumigated will remain clean for three years before it is necessary to repeat the operation. Thus the cost of keeping an orchard free from scale is now only one-sixth of what it used to be in the days of commercial and unscientific treatment.

The work in Florida against the white fly having demonstrated that in most cases the gas treatment is too expensive, attention has been directed to the determination of the most practical and effective spray application. Tests have been made on a large scale, often over entire orchards, with a variety of insecticides, and it now seems rather well demonstrated that spraying will, under Florida conditions, be more generally adopted in the future than control by fumigation. The expert who was sent abroad in a search for the original home of the white fly, and with the idea of importing from this locality, when found, parasites or natural enemies which could be established in the Florida orange groves, has been successful in at least a part of his mission. In November, 1910, he found the white fly at Seharunpur, India, under conditions that appear to indicate that the white fly is indigenous to that part of the world. He has found that it is attacked by two species of ladybird beetles, and he has also found an internal parasite. A large part of the present year has been devoted to the effort to secure the parasites in sufficient numbers and in proper condition to permit sending them successfully to this country. He has established the white fly on small growing trees, and has secured living specimens of the parasite breeding in these white flies, and the trees themselves will be brought to the United States in Wardian cases.

The investigation of the orange thrips, begun at Lindsay, Cal., has been extended to southern California, especially in the Riverside district, where it seems to be causing considerable damage. Application of a spray consisting of a lime-sulphur solution with a tobacco extract added is the best remedy so far found.

WORK AGAINST FOREST INSECTS.

It is significant of the practical nature of the methods of bark-beetle control recommended by the Bureau of Entomology and of the practical demonstrations that have been carried on that no complaints of depredations have come to the bureau during the year from the areas in Colorado and Montana where control work was carried on in previous years according to the instructions of the bureau. During the past year the work has been principally in the way of practical demonstrations, as the result of the investigations of previous years. As an example, in cooperation with private owners in the vicinity of Columbia Falls, Mont., over 10,000 trees were treated. Formerly 10,000 trees died each year, but as the result of last year's work only 2,000 required treatment this year within an area of more than 100 square miles. This is undoubtedly the direct result of the control work of last year, which cost nothing, since the treated trees when utilized for fuel and lumber are worth far more than the cost of treatment. Work done in cooperation with the Interior Department on the Glacier National Park resulted in the treatment of 1,295 trees in the vicinity of McDonald Lake, and the present conditions indicate that the work has been successful in arresting the spread of the damage.

Active control work was undertaken in northeastern Oregon in the fall of 1910, and was completed June 30, 1911. This work was done by the Bureau of Entomology, in cooperation with the Forest Service, with private owners, and with the General Land Office of the Department of the Interior. The preliminary reports indicate that 27,158 trees were treated at a cost of $33,180 to the Forest Service, and that 6,853 trees were treated at a cost of $2,806 to private owners. More than 100 men were engaged in the work during May and June. The results of this large control demonstration can not be known until the close of the present fiscal year, but it is believed that they will prove to be successful, and that the demonstration of methods and the training of men for control work will be of the greatest value in the future.

It is estimated that the timber saved as the direct result of control work in the Rocky Mountain region, under instructions from the Bureau of Entomology or according to its recommendations, represents a stumpage value of $2,000,000.

INSPECTION WORK.

In my last report I called attention to the urgent need of the passage by Congress of a plant quarantine and inspection law, and showed that the United States is the only great power without a law to protect it from the introduction of plant diseases and insect pests. Practically all of the European and other foreign powers have such laws, as have also Canada and the other important English colonies. The United States has become a dumping ground for refuse stock, much of which comes to this country to be sold by auctioneers under the hammer. The better class of nursery stock is also often infested with insect pests or diseases which could be detected by proper inspection. More than half of the important insect pests of the fruit and farm products of this country were originally brought in on imported nursery stock, and these now occasion an annual tax of several hundred millions of dollars. The San Jose scale, the cotton boll weevil, the gipsy moth, and the brown-tail moth are instances of accidental importations, and the alfalfa weevil mentioned in a previous paragraph is another. Since my last report infested stock has been constantly coming in. The Bureau of Entomology has been notified by the customhouses and by the railroads when plants are received, and such arrangements as could be made for inspection at points of destination have been carried out. In most of the States there are efficient inspection laws and efficient inspectors. To exemplify the danger of the present condition of affairs, during the past year a careful inspection of the importations by the Department of Agriculture showed that more than 20 different pests had been brought to Washington from foreign countries on plants. Of course these were intercepted and destroyed, but the presence of 20 new pests whose capacities for crop destruction were undoubtedly very great affords the strongest possible argument for the passage of a National plant quarantine and inspection law. On three different occasions during the past year the gipsy moth has come in on imported stock consigned to different localities in the country.

OTHER WORK.

Other important operations carried on by the bureau during the year may be briefly mentioned. The work against the cotton boll weevil has been continued. The weevil extended its range during the year into the State of Alabama. On the other hand, it was entirely absent from certain regions in northern Texas, where it was present last year. It also did no noticeable damage in Oklahoma. Studies of the parasites of the weevil were continued, and Texas parasites were introduced at two points in Louisiana. The work on tobacco insects was also continued. A notable discovery was made with regard to the so-called tobacco wireworm which indicates that it can be controlled by cultural means. It feeds naturally upon certain weeds and these weeds are eliminated by rotation of crops. In the study of sugar-cane insects new points of importance were ascertained. The Argentine ant and the cotton red spider work was continued. Demonstration work in the deciduous fruit regions in California, with remedies for the pear thrips, was carried on with excellent success, indicating that in prune orchards the yield from an acre treated according to the directions of the bureau reached a value of $367.93, where an untreated acre yielded only $6.65. Work upon the codling moth, plum curculio, Hessian fly, and the jointworm has been continued with success, and important advances have been made in methods of fighting insects affecting vegetable crops and stored products. Information on the subject of the house fly as a carrier of typhoid fever and on malarial mosquitoes has been published, and the study of the tick which transmits Rocky Mountain spotted fever has been completed. Further studies upon the cattle tick have been made, and an investigation of the possible influence of certain insects in the carriage of pellagra has been begun. The work on bee diseases has been continued.

BUREAU OF BIOLOGICAL SURVEY.

RATS AND THE PLAGUE.

The rat is one of the most destructive mammals known, and the vast losses it annually causes in the United States call for increased efforts to reduce its numbers and to exterminate it wherever possible. Moreover, the continuance of the bubonic plague in foreign countries. with which we have constant trade relations emphasizes the danger of the landing of plague-stricken rats from incoming ships, and renders imperative the need of perfecting means for the destruction of these vermin, now believed to be the chief means for disseminating this dread disease. During the past year experiments were continued to discover effective means of reducing the numbers of this pest, without the discovery, however, of methods superior to those recommended in Farmers' Bulletin 369. While poison and traps must continue to be the chief means of reducing the numbers of these mischievous rodents in public buildings, dwellings, stores, and warehouses, it can not be too strongly urged that preventive methods are vastly easier, much more effective, and in the long run cheaper. The rat-proofing of buildings, especially those in which foodstuffs are stored, should be insisted on as far as possible. This precaution, coupled with the withholding of food so as to reduce reproductory powers and make trapping and poisoning effective, will result in materially reducing the number of the pests and lessening the danger from them.

GROUND SQUIRRELS AND THE PLAGUE.

Throughout much of the region west of the Mississippi River ground squirrels of many species abound. In past years much time and attention has been given to the study of the habits of these rodents and of methods of controlling them, since wherever found they are exceedingly destructive to farm crops, and in irrigation districts they do much damage by burrowing into embankments, thereby causing costly breaks. The spread of bubonic plague by rats to the ground squirrels of California, discovered by the Public Health and Marine-Hospital Service, is a matter of national importance, since there is danger not only that the disease may become endemic in that particular State but eventually, through the agency of other species of ground squirrels, spread to neighboring States and thus threaten the whole country. As yet plague germs have been found in only one other native rodent, the California wood rat, and in only one individual of that species. The destruction of a mammal so numerous and so widely distributed as the California ground squirrel is a very serious undertaking on account of the great cost involved, and yet safety from the plague can apparently be fully assured in no other way.

During the year careful experiments were made to discover, if possible, better and cheaper methods of poisoning ground squirrels, and a circular embodying the results of these experiments was published. The formulas in Biological Survey Circular 76 can be confidently recommended for cheapness and effectiveness. This circular has been widely distributed throughout California, with a view to stimulating activity on the part of resident farmers and landowners generally in the work of ridding their lands of ground squirrels. When fully advised of the importance of the work, they have usually shown themselves ready to do their part. The present law of California, which requires the cooperation of all landowners in the work of exterminating ground squirrels, will, if fully enforced, go far toward providing a remedy, especially if the State, through county and other officials, arranges for furnishing poison or poisoned bait in necessary quantities to landowners at cost. By providing centers of distribution the poison can be supplied ready for use at comparatively low cost, which will greatly stimulate its use by farmers and others.

RELATION OF NATIVE MAMMALS TO SPOTTED FEVER.

The recently ascertained agency of certain of our native mammals in the transmission of diseases vastly increases the importance of a knowledge of the exact range of the species concerned and their habits. It is now known that the so-called spotted fever of the Rocky Mountain region is transmitted from certain native mammals to men through the agency of ticks. In its most virulent form this fever, fortunately, has a restricted range, being confined to a portion of Bitterroot Valley, western Montana; but in milder form it prevails in parts of Idaho, Wyoming, Utah, and Nevada, and probably elsewhere in the Rocky Mountain region. During the past year the Biological Survey, the Bureau of Entomology, and the Agricultural Experiment Station of Montana cooperated in a field and laboratory study of the agencies and manner by which the disease is transmitted to human beings. The work of the Biological Survey was chiefly confined to ascertaining the species of native mammals which carry ticks in any stage of development, since presumably one or more of these mammals is, if not the original, the chief source of infection.

A collection of the mammals of the valley and adjacent mountains was made and the ticks discovered were turned over to the assistants of the Bureau of Entomology for experiment and study. No fewer than 18 species of mammals were found to harbor fever ticks—proof of the great difficulty that must necessarily attend any attempts to exterminate all the wild hosts of the ticks over the region in which the fever prevails. The mammal found to be most frequently infested—possibly in this respect equaling all other wild mammals combined—is the common ground squirrel of the region (*Citellus columbianus*), which abounds over much of the valley. As a very important step in the suppression of the disease, a thoroughly organized campaign to exterminate this squirrel within the limits of the valley should be made. Such a campaign may be urged on the double ground of the public health and the advantage of the farmer, since this mammal is a very serious pest, not only in this particular valley, but wherever grain is sown in Washington, Oregon, Idaho, and Montana. In connection with a study of the local wild mammals, an assistant of the Biological Survey during the coming season will demonstrate to the people within the infested district the best method of exterminating this ground squirrel and other wild mammals that carry ticks. By means of State or county cooperation the small tick-carrying mammals of the western side of Bitterroot Valley, the area chiefly affected, could be exterminated at a comparatively small outlay of time and money.

PRAIRIE DOGS.

Prairie dogs continue to be a scourge to farmers in many sections of the Middle West, and they exact heavy toll also from the stockmen by eating nutritious wild grasses which form the main reliance of range cattle. Their colonies sometimes number thousands of individuals, and as it requires only about 200 to consume the forage of a steer their colonies collectively are a heavy drain on both pasturage and crops. During the year many experiments have been made with a view to finding better methods of poisoning or otherwise destroying these animals without at the same time endangering the lives of valuable birds.

SILVER FOX INDUSTRY.

During the past year many inquiries have been received from various parts of the United States regarding the practicability of rearing the silver or black foxes for profit, and there is a steady demand for the Farmers' Bulletin on this subject. Interest in the business has no doubt been stimulated by the enormous prices obtained for skins, and even larger sums paid for first-class breeding animals. Efforts are being made to obtain all possible information as to the success of breeders who have engaged in the business with a view to issuing a supplemental report on the industry.

WOODPECKERS.

As a class, woodpeckers are among our most useful birds. They destroy numbers of noxious insects and lend effective aid to the preservation of forests, city shade trees, and fruit orchards. A bulletin on these birds was issued during the year, analyzing the food they eat, explaining the ways in which they are of value to the farmer, and indicating methods by which their number may be increased by the use of artificial nesting sites.

Unfortunately there is one small group of woodpeckers, properly known as "sapsuckers," which are destructive rather than beneficial. Still they must be credited with doing some good by eating insects, though they do much injury by pecking holes in the bark of trees, especially fruit trees, for the purpose of obtaining the inner bark and the sap, both of which are highly relished for food. As they return to the same tree time after time, and often season after season, the area denuded of bark constantly grows larger, and many young trees are killed. Moreover, the effect of their boring is visible in the shape of checks, distortions, and stains years afterwards when the trees are felled and worked up into lumber. It has been estimated that the damage to wood products in the United States by these sapsuckers is more than a million dollars yearly. This investigation of the habits of the sapsuckers and the kind and extent of the injuries they inflict on trees and lumber appears in the form of a bulletin, together with suggestions as to the best method of protecting trees from their attacks.

SHORE BIRDS.

Notwithstanding their small size and the fact that many of them retire to the far North to breed, our shore birds have been so ruthlessly pursued by gunners that all of them are fast diminishing in numbers, at least one species has been exterminated, and several others are nearing the same end. The value of shore birds as food is widely recognized and is indeed the chief cause of their present scarcity. But few are aware that many of them do good service by eating noxious insects, including mosquitoes in the larval state. Being valuable both for food and because they destroy insects, their extermination would be a calamity, especially as during some part of the year they visit every State in the Union and range from ocean to ocean. The prohibition of the sale of these birds, the abolition of spring shooting, and the restriction of the bag limit in the open season will probably result in preserving the several species for future generations.

CRAYFISH.

In certain regions of the Southern States, particularly in northeastern Mississippi and Alabama, crayfish are very numerous, and in their early stages do much damage to crops, such as corn, cotton, and other staples. In the States mentioned they infest a territory of approximately 1,000 square miles and in certain restricted sections fairly swarm, their holes numbering thousands to the acre. In such places successful crop raising is impossible, and a large acreage noted for its fertility is practically useless because of the depredations of these crustaceans. Investigations have been begun, having in view the discovery of a method of trapping the crustaceans in large numbers and their utilization for food, or their destruction in their holes by means of a deadly gas. The experiments are not yet far enough advanced to warrant definite statements, but excellent results have been obtained by the use of gas.

BIOLOGIC SURVEY OF CANAL ZONE.

The construction of a canal across the Isthmus of Panama from ocean to ocean must ultimately affect the distribution of marine life along both coasts, while the physical changes wrought along the line of the new waterway, including the creation of a great fresh-water lake, the destruction of a belt of native forest, and the inevitable introduction by commerce of new forms of both plant and animal life, must also considerably change Isthmian biology. A biologic survey of the Isthmus for the purpose of adding to our scientific knowledge of this recently acquired strip of territory and as a means of determining the nature and extent of future changes seemed very important, and a plan of work was entered into in cooperation with the Secretary of the Smithsonian Institution, the Secretary of War, and the Secretary of Commerce and Labor. Under this cooperation an assistant of the Biological Survey has for several months been engaged in making collections of the birds and mammals of the Canal Zone as a basis for a comprehensive report upon these branches. The Isthmian region is rich in both these groups, and the collections already sent in are an earnest of the rich harvest of scientific data and specimens to be expected when the work is completed.

EXPEDITION TO LAYSAN ISLAND.

One of the largest sea-bird rookeries in the world is that on the island of Laysan, the most important of a series of oceanic islands, some 600 miles northwest of the Hawaiian Islands. These islands were set apart as a bird reservation February 3, 1909.

About two years ago Laysan was raided by alien feather hunters and a vast number of birds were killed for their plumage. During the year the University of Iowa planned an expedition to the island in order to secure material for representative groups of sea birds to form part of the university museum exhibit, and the cooperation of this department was sought for the purpose. The four men selected by the university were appointed temporary wardens of the department and, in addition to a representative series of the birds of the island, they will furnish a detailed report of the present condition of the rookeries, the number of birds that breed there, and the effect on the prosperity of the colony of the raid of the feather hunters mentioned above.

BIOLOGICAL INVESTIGATIONS.

Biological investigations have been carried on during the year in Alabama, Arkansas, Idaho, Kentucky, Montana, Tennessee, Wyoming, and Virginia, and the information gathered has added much to our knowledge of the distribution, abundance, habits, and economic relations of mammals and birds. It has also yielded data for numerous corrections of life and crop zone maps and enabled answers to be given to numerous inquiries as to the crops best suited to specified areas.

A revised and corrected edition of the zone map of North America has been published during the year, and for the first time the outlines of the Tropical and Hudsonian Zones have been shown with some detail. While mainly extralimital, both these zones are represented in the United States; the Tropical in Florida, the Hudsonian on the higher mountains and in Alaska.

A report on the biological survey of Colorado has been issued and distributed. It covers the subject of life and crop zones of the State and includes a detailed zone map and a fully annotated list of the mammals.

GAME PRESERVATION AND INTRODUCTION.

While the need of game protection is each year better understood, and while effective legislation for the preservation of game becomes yearly more general among the States, it is apparent that the extinction of the wilderness by growing settlement must, sooner or later, deprive the United States of most of its big game, except as it may be preserved on lands set apart for that purpose. Hence, in addition to unremitting efforts to prevent rapid destruction of game by market hunting or excessive killing for sport, growing attention is demanded by the question of game preserves, both private and public. The Biological Survey has devoted much consideration to this phase of game preservation, and much work has been done in connection with game preserves and bird reservations.

ELK IN WYOMING.

At the close of the session the Sixty-first Congress made an appropriation of $20,000 for the feeding, protecting, and removing of elk in the region known as Jacksons Hole and vicinity, Wyoming. As soon as the appropriation became available two representatives of the Biological Survey were sent to Wyoming to do whatever was possible for the starving elk. As all the available hay had been secured by the State and was being fed to the elk, attention was turned to other phases of the problem, such as the conditions responsible for lack of food, the number of elk that died from starvation, the possibility of securing an adequate supply of hay for next winter, the location of available sites for winter refuges, and the practicability of transferring elk to other localities. As an experiment two small herds were transferred to the National Bison Range and the Wichita Game Refuge, and careful consideration has been given to the feasibility of moving others to the Medicine Bow Mountains and the Big Horn Range next winter. In short, a thorough study is being made of the elk problem in all its phases, and a report on the subject will soon be ready.

IMPORTATIONS.

The necessity for constant watchfulness to prevent the introduction of foreign birds and mammals likely to become pests continues to be manifest. Three mongooses brought to New York in February, 1911, were promptly killed on board ship, and one mongoose and two flying foxes on exhibition at Kansas City were placed in the safe custody of zoological parks.

The importation of European partridges, which last year dropped from 30,000 to 18,000, rose again to 36,507. While this increase seems to show a growth, or at least a continuance, of the popularity of this bird for stocking covers, yet from other sources it is evident that repeated failures to acclimatize it have had a discouraging effect. It is important to note that 10,000 of the partridges imported in the current year were consigned to one destination—the State of Iowa, which has undertaken the experiment of acclimatization on an unusually large scale.

BIRD RESERVATIONS.

One new bird reservation was established during the year on the Clear Lake Reservoir in the northern part of California, a few miles southeast of Klamath Lake. This reservation, which increased the total number to 52, is an important breeding ground for birds. Owing to the growing importance of questions arising in connection with three of the reservations in Oregon and Idaho, an inspector was appointed to visit them from time to time. Adjustment of relations with the public in connection with the maintenance of the Deer Flat Reservation will require careful consideration. The Deer Flat Reservoir is the stopping place for thousands of ducks and many other waterfowl in the fall migration; it promises also to be an important nesting ground for waterfowl in the future. It is essential, therefore, that it receive special attention if its purpose as a bird reservation is to be maintained. The lake, however, is situated only 6 miles from Caldwell and is likely to become a summer resort. A trolley line connects it with Caldwell, and boats have been placed on the water for the use of excursionists. It may be found necessary to keep part of the lake free from intrusion by pleasure seekers, at least during the nesting season. The question of stocking the reservoirs of Cold Springs, Oreg.; Deer Flat and Minidoka, Idaho; and Belle Fourche, S. Dak., with fish was taken up with the Bureau of Fisheries, and it is probable that these reservations for birds will soon become reservations for fish as well.

NATIONAL BISON RANGE.

No damage was done to the National Bison Range, in Montana, by the forest fires of 1910, although they raged around it only a short distance away. Fifteen buffalo calves were born in the spring of 1911, and 3 adult buffalo, presented by the American Bison Society, were placed on the range. Twelve antelope from the Yellowstone National Park and 7 elk from Jacksons Hole, Wyoming, were added to the occupants of the range during the year. Four of the antelope died, and as no deer have been seen recently, the game on the range at the close of the year comprised 66 buffalo, 8 antelope, and 7 elk. In this connection it may be mentioned that the American Bison Society is taking steps, in cooperation with this department, to secure ground for an additional bison range in South Dakota.

ALASKA.

More rigid protection of deer and walrus in Alaska having been found necessary, new regulations were issued on July 29, 1910, shortening the hunting seasons, limiting the number of deer which may be killed by each hunter, preventing the sale of venison during 1911, and prohibiting all killing of walrus in Bristol Bay and south of the Kuskokwim River until 1912. Only five wardens were employed during the year, but this number will be augmented next year owing to an increase of $5,000 made by Congress in the appropriation for warden service in 1912.

DIVISION OF ACCOUNTS AND DISBURSEMENTS.

During the year there were received, audited, and paid 118,921 accounts, amounting to $15,736,198.02. More than 4,200 of these accounts, moreover, were so-called combined accounts, in connection with which there was probably a saving of at least 21,000 checks, to say nothing of the saving of other clerical labor in connection therewith. There were also audited and sent to the Treasury for payment 4,368 accounts. In the payment of the 118,921 accounts mentioned above it was necessary to draw 244 requisitions on the Treasury and subtreasuries and issue 225,019 checks. There were issued during the year 27,345 requisitions for supplies, 7,063 letters of authorization for travel, 44,976 requests for passenger travel, and 9,020 requests for department bills of lading and requests on the Quartermaster General for the transportation of Government property, while about 158,100 letters were written or received in the ordinary transaction of business.

To carry on the work of the Department of Agriculture during the fiscal year ended June 30, 1911, Congress appropriated $13,487,-636 for the ordinary expenses of the department, in addition to which permanent annual appropriations amounting to $6,329,000 and special appropriations amounting to $1,874,614 were available, making a total of $21,691,250.

The disbursements of the department for the fiscal year 1911 amounted to $17,188,339.27, and the greater part of the balance of $4,496,348.68 will be required for the settlement of outstanding liabilities.

The amount for rent of buildings in the District of Columbia for the several branches of the department was $70,481.86.

All accounts for the fiscal year 1909 having been settled, the unexpended balance of appropriations for that year, amounting to $306,333.71, was covered into the Treasury on June 30, 1911. The account for the fiscal year 1910 is still open.

The amount estimated for the fiscal year 1913 in the annual estimates for the regular appropriation bill is $17,233,452, which includes $1,440,000 for agricultural experiment stations; in addition to which there will be available permanent annual appropriations amounting to $5,706,000, making a total of $22,939,452. There is also an estimate in the sundry civil bill for printing and binding for this department amounting to $480,000, making a grand total of $23,419,452, which is an increase of $340,436 over the appropriations for the fiscal year 1912. This amount will be used for establishing new Weather Bureau stations in the fruit and horticultural sections; for extension of the dairy and animal husbandry work in the eradication of tuberculosis in domestic animals; for an extension of farm management investigations and demonstration work in the northern States, and an enlargement of the scope of pathological investigations; for additional range investigations and tree planting; for an extension of the work under the enforcement of the food and drugs act; for an extension of the soil survey work; for an extension of the work under enforcement of the insecticide act; and for an extension of the work on road management and experimental roads.

DIVISION OF PUBLICATIONS.

The number of different publications, circulars, and reports issued by the department during the year ended June 30, 1911, was 1,953, which is 29 less than during the previous year, but the number of copies printed for distribution to farmers and others interested in agriculture aggregated 27,594,877, which is 2,404,408, or nearly 10 per cent, more than during any previous year. This gratifying result was accomplished without any increase in the appropriation for printing and with a slight decrease both in the appropriation and in the force available for the division work.

Of the documents mentioned above, 27,250,250 were issued through the Division of Publications, and 344,627 were issued through the

Weather Bureau; 18,468,277 copies were of publications issued during the year and 9,126,600 were reprints of publications which had been previously issued, but for which there was still a considerable demand. Of Farmers' Bulletins, 9,219,000 were secured with the appropriation available, 2,054,000 of which were copies of new bulletins and 7,165,000 were reprints. Many of the Farmers' Bulletins have long been in use by the farmers and a large demand still exists for them.

Inasmuch as the amount expended in acquiring the information appearing in the department's publications is more than $16,000,000, the appropriation of less than half a million dollars for printing and binding, of which only about $360,000 is available for printing reports, bulletins, and circulars for distribution among the people, in order that they may avail themselves of the results of this outlay and these investigations, is small and inadequate. If the available information could be placed in the hands of every farmer, a fuller measure of usefulness should be achieved by the department.

POPULAR DEMAND FOR PUBLICATIONS.

Even with the increased number of publications printed and distributed during the year, it was impossible to supply the popular demand, which came from every section of the United States and from many other parts of the world. The department would have required at least 5,000,000 bulletins more than were at its disposal to have met the demand fully, and it was found necessary to select and send a few bulletins likely to be most useful to those whose request had been for many more, and by this course make it possible to supply at least some bulletins to each applicant, instead of exhausting the department's supply in attempting to entirely satisfy a few. The distribution of this reading matter widely disseminates information along agricultural lines and is productive of a higher yield of better crops, better breeds of stock, new varieties of fruits, and improved conditions on the farm, the financial value of which alone amounts to millions of dollars annually, but the increase in comfort, contentment, and cheer can not be estimated.

FARMERS' BULLETINS.

With the present appropriation of $125,000, it was possible to make an allotment to each Senator, Representative, and Delegate of approximately 12,500 Farmers' Bulletins, which was admittedly insufficient in view of the increasing number of requests received from them. Therefore, the matter of securing a sufficient appropriation should be considered with the view to increasing the allotment. Under the law only one-fifth of the Farmers' Bulletins furnished were available for distribution by the department, and this is not sufficient to permit it to comply with one-half of the requests received, and makes it necessary to refer applicants to their Senators, Representatives, and Delegates, who themselves, in many cases, have already exhausted their supply. Hence it is obviously desirable that both the congressional and departmental allotments should be increased. An addition of $25,000 to the printing bill, available for printing Farmers' Bulletins, would increase the allotment to each Senator, Representative, and Delegate to 15,000, and would enable the department to more nearly comply with the demands made upon it.

AN ALLOTMENT OF EVERY PUBLICATION FOR SENATORS, REPRESENTATIVES, AND DELEGATES IN CONGRESS.

There is a constantly increasing demand for publications other than Farmers' Bulletins from Senators, Representatives, and Delegates in Congress, which the department is unable to supply, very much to its regret. These publications contain the results of our scientific investigations and experiments acquired at considerable expense, and they should receive the widest possible distribution among the people for whom they are intended. This, however, is not possible under the present system and with the available funds. So satisfactory has been the distribution of Farmers' Bulletins that I am persuaded to recommend that an allotment of every publication issued by the department be made to Senators, Representatives, and Delegates in Congress. They are in close touch with the people and would be able to give the publications a wider and wiser distribution than they now receive. A considerable increase in the appropriation for printing would be necessary, but it is believed that the results would be so valuable and enduring to the people as to justify the additional expenditure. The subject is worthy of serious consideration.

SCIENTIFIC AND TECHNICAL PUBLICATIONS.

Our scientists are constantly conducting investigations and making important discoveries which are of great value to agriculture, but the published results are not always adapted to the present uses of the great mass of the department's correspondents. The information they contain is necessarily couched in more technical and scientific language than is desirable in popular pamphlets; hence the bulletins are printed in limited editions as permanent records of the achievements of the department in scientific research, and for distribution to libraries, collaborators, and scientists, both in this country and abroad, and to such persons as are likely to find them of special value. Publications of this class represent only about 2 per cent of the total output, but owing to their greater length, the use of more expensive illustrations, and the necessity for more expensive paper, they use up about 20 per cent of the appropriation for printing and binding. The advisability of securing additional funds for publishing larger editions of bulletins of this class should be seriously considered, as it is believed that the publications should have a wider distribution.

ECONOMIES EFFECTED.

The channel through which the department distributes the results of its investigations and other information it desires to disseminate among the people, and especially the rural population, is its publications, the editing and distribution of which is the province of the Division of Publications. It is the function of that division to meet the department's requirements for printing and binding and to accomplish this with an almost always inadequate appropriation. Hence the economies of the division tend in the editorial work to the condensation of statement and improvement in form of the printed documents, and in the distribution work to closer organization and efficiency and expedition.

The extent of the work performed in the division is dependent upon the growth of the department and the activity of its various agencies, and this activity depends upon so many extraneous conditions that it is not possible to even approximate at the beginning of the year the amount of printing which will be required. Its operations, therefore, may be accepted as an accurate index of the department's work. The magnitude of the work devolving upon the editors is apparent when the large number of publications issued and the enormous amount of miscellaneous printing required by the department are taken into consideration.

Perhaps the most striking feature of this division's work was its success in promoting economy. Many manuscripts were reduced in size, illustrations were limited to those absolutely necessary to illustrate the text, and the tables were greatly condensed.

In many cases large savings were effected in the cost by reduction or other changes in the shape or size of blanks, eliminating waste in cutting the paper and substituting a perfectly satisfactory paper, but of a cheaper grade, for a high-priced article no better fitted for the purpose. The economy effected in this kind of work, however, is not confined to the manuscript and illustrations after being submitted. The division's supervision has exercised a healthful influence throughout the department, tending to a more careful preparation of the manuscripts, a more critical selection and minimization of illustrations, and less change in proof of the authors. The use of a more durable paper for some of the publications of the department has been adopted, insuring the permanent preservation of its valuable publications and at the same time lessening the weight of the bulletins; while for the publications issued in large editions and of a more temporary value a lighter paper has been adopted, reducing both the cost to the department and the cost of transportation through the mails. To add to the value and completeness of the publications indexes are prepared for those which are of such size as to require it. The division also prepares and maintains a detailed card index of the contents of all publications of the department—perhaps the only one in existence.

ILLUSTRATIONS.

During the year the division prepared 1,566 original drawings, produced 71,224 photographs, and filled 224 orders from outside departments for photographic work, which required the reproduction of 2,694 photographs, costing the purchasers $596.53. On the order of the department 1,252 duplicate electrotypes of illustrations were made for miscellaneous applicants by private firms, for which the applicants paid to the manufacturers a stipulated price per square inch. This growth in the photographic work has continued without increase in force. These facts do not convey an adequate idea of the constantly increasing demand upon that branch of the division from the other bureaus of the department, nor do they indicate the amount of labor and skill necessary to produce such technical and artistically correct illustrations as appear in the department's publications.

SALES OF DEPARTMENT PUBLICATIONS.

As stated above, the department is often unable to furnish publications requested by applicants, either because the supply is exhausted, or because the publication is of such a character that it can not be widely and gratuitously distributed. To meet such cases Congress has wisely provided a relief through the Office of Superintendent of Documents of the Government Printing Office.

This official is authorized by law to sell Government publications at the nominal cost of printing and paper plus 10 per cent, and his sale of the publications of the Department of Agriculture during the last six years shows how increasingly interested the people have become in the department's work, for in 1906 only 47,745 copies of our publications, costing the receivers $5,388.28, were sold, while in 1911 the same official disposed of 183,577 copies, at a cost to the purchasers of $18,657.17. Under the operations of the law the Superintendent of Documents is permitted to reprint and sell publications as long as there is a demand for them, paying for the reprinting out of the receipts from previous sales. During the year he reprinted 633 publications of the department, the editions aggregating 170,325 copies. Thus only 13,252 of the number sold by the Superintendent of Documents were furnished by the department.

In previous years the records of the Office of Superintendent of Documents indicated that the purchases were generally from among the scientific and technical publications of the department, but current records show that while there has been a healthy increase in the number of scientific and technical department bulletins distributed through his office the great increase shown by his report was in the more popular and smaller publications, which give in a practical way the results of the scientific investigations. This proves that the rural population in greater numbers is seeking the aid of the department and is willing to pay for the documents needed when the department's supply will not permit of gratuitous distribution.

PUBLICATIONS FOR RESTRICTED AREAS.

The department's correspondence relating to its publications shows an increasing demand for information relating to particular localities or sections of the country, which it is often difficult to supply in printed form and which requires a disproportionate amount of labor to present in an individual letter.

During the last two years there has been an increasing demand for information in regard to the agricultural possibilities of the different States. Information of this kind can be found in the soil surveys; but these, owing to the colored maps, are expensive, and, moreover, are not available for general distribution, as the editions for departmental use are limited to 1,000 copies. The appropriation for Farmers' Bulletins provides for publications adapted to different sections, and many of those more recently issued have been prepared with a view to the needs of restricted areas. A Farmers' Bulletin for each State, presented in popular style, is therefore contemplated.

LARGER EDITIONS OF 100-PAGE PUBLICATIONS.

Under the provisions of the printing bill now pending in Congress it would be possible for the department to print as many as 2,500 copies of bulletins exceeding 100 octavo pages, which at present and for several years have been limited to editions of 1,000 copies. In many cases these bulletins have been of great scientific value, and the inability to distribute them more widely among the colleges and universities and in the scientific world generally has been a matter of regret and has deprived many of valuable information. It is hoped that the provision will prevail.

USE OF OUR PUBLICATIONS BY SCHOOLS.

The demand for the department's publications for use in schools of all grades continues to increase and is far beyond our ability to supply. Of course an effort is always made to furnish to each school making requests as varied and as large a supply as the limited number at our disposal justifies, for it is believed that such distribution encourages agriculture and increases the prosperity of the Republic. An increase of the appropriation with the view of more nearly meeting the demands of these young men and women is worthy of serious consideration.

BUREAU OF STATISTICS.

The quantitative interpretation of the figures indicating the monthly condition of those growing crops of which estimates of production are made at the close of each year is an important feature added this year to the crop-reporting system of the department.

Since the significance of the monthly condition figures has been interpreted by the department, the various private interpretations, both by individuals and commercial organizations, differing in their statements, have practically ceased, and it has been generally conceded in all quarters that the interpretations emanating from the Bureau of Statistics are the fairest and the most authentic figures possible to be based on the crop condition report.

All the leading crops except cotton are included in these quantitative interpretations. With cotton, however, it is impracticable to interpret the condition figures, as the amount of abandoned acreage is lacking, can not be ascertained until the close of the season, and is essential to reasonable accuracy in the translation.

COST OF CROP PRODUCTION.

The result of the investigation upon the cost of producing corn, wheat, and oats, published in several numbers of the Crop Reporter, made it evident that the cost of producing crops varies widely in different sections of the country. The average cost per bushel of producing corn was found to be 37.9 cents (including rental charges), varying by States from 30 cents in Iowa and South Dakota to 72 cents in Maine; the average cost of producing wheat was 66 cents per bushel (including rental charges), varying by States from 44 cents in Montana to 96 cents in South Carolina; and the average cost of producing oats was 31 cents per bushel (including rental), varying by States from 23 cents in Montana to 56 cents in Connecticut.

It is proposed to continue this line of investigation.

PROPORTIONED CAUSE OF CROP DAMAGE.

The results of the first inquiry into the amount of damage done to each important crop in 1909 was published in November, 1910. The summary showed that 81.8 per cent of the total damage is attributed to unfavorable climatic conditions, 4.8 per cent to plant diseases, 7.9 per cent to insect pests, 1 per cent to animal pests, 1 per cent to defective seed, and 3.5 per cent to unknown causes.

CROP REPORTING.

Investigations of the crop-reporting systems of several countries of Europe show beyond doubt that the systems of the countries visited contain no better features, and, as a rule, cover no range broader than our own; in fact, it was found that the system prevailing in this department, and already many years in operation, is far in advance of that of any other country.

Many thousand reports received regularly from the voluntary correspondents are tabulated, and these form the basis of the crop report figures given out each month.

The total number of questions asked of all classes of correspondents in the calendar year 1910 amounted to 2,582. Of these 2,003 were for use in making the crop report and 579 for special investigations. From the township correspondents alone 2,427,000 replies were received.

A notable addition to the monthly reports of prices was a schedule comprising about 30 of the principal products of the farm other than the 14 which are reported on by the county correspondents.

A comparative statement of monthly receipts of eggs and poultry was compiled each month and published in the Crop Reporter, showing the relative increase or decrease from month to month in the quantities received by large dealers who buy from the country, and the receipts at important markets.

If the preliminary work attempted toward compiling a statement of the quantity of apples shipped from the principal producing regions is successful, such a statement will be issued in the near future.

AGRICULTURAL PRODUCTION AND POPULATION.

Owing to the prevalence of high prices there has developed a general impression that the agriculture of this country is unequal to the needs of the increasing population. An investigation of the facts with regard to this condition failed to establish any cause for alarm. On the contrary, it is evident that this country has been passing through phases of agriculture in which declines in production per acre are the result of exploiting new land and in which recuperation follows with a pace greater than that of increase of population.

Just prior to the close of the fiscal year two investigations were begun relating to the development of agriculture as influenced by transportation companies, one with special reference to such topics as the movement of agricultural population and the occupation of railroad lands, and the other to the changes in the cost of distributing perishable farm products.

COST OF FARMERS' SUPPLIES.

From an extensive inquiry made among retail dealers doing business with farmers it appears that most articles purchased by farmers cost more in 1910 than in 1909, the average increase being about 1.5 per cent. The purchasing power of produce of 1 acre in 1910 was 7.3 per cent less than in 1909, but still about 44.1 per cent more than in 1899.

SEEDTIME AND HARVEST.

An unusually large undertaking of the pioneer sort was the work in the investigation of the dates of planting and harvesting in the United States and foreign countries, which has been continued and is so far advanced that the report on cereal crops, flax, cotton, and tobacco is now in press, and there is prospect of completing the reports on forage crops, truck crops, and seedtime and harvest in foreign countries during the fiscal year 1912. The plans of the work have been original, and in the processes of treating the primary materials for the deduction of conclusions there have been many practical problems to solve.

LIBRARY.

The accessions to the department Library during the past year, exclusive of current periodicals, exceeded those of any previous year and amounted to 8,816, bringing the total number of books and pamphlets on July 1, 1911, to 115,653. More than half of these accessions were received by gift or in exchange for department publications. In addition to the accessions noted above the Library received currently nearly 2,000 periodicals.

During the year the Library completed the first volume of its Monthly Bulletin, for which an author index was issued, thus rendering the Bulletin more useful for reference than was the case with the former list of accessions.

Although the Library's collection of books on agriculture and related subjects is probably unsurpassed in the country, the resources of other libraries are also used to aid in the investigations of the department, 6,397 volumes having been borrowed during the year from Washington libraries and 69 from libraries in other cities. On the other hand, the department Library is frequently called upon to lend books to scientific institutions outside the city, especially to the State agricultural colleges and experiment stations. During the year 615 books were thus lent. Several of the other Government offices in the city also use the Library freely.

During the year about 2,000 duplicates received by the Library, for the most part official publications, were distributed to the libraries of the State agricultural colleges and experiment stations to help in completing their files.

OFFICE OF EXPERIMENT STATIONS.

RELATIONS WITH AGRICULTURAL EXPERIMENT STATIONS.

The better financial conditions resulting from the increased Federal funds and other resources, as well as the growing demands of a progressive agriculture in general, have continued during the year to increase the working efficiency of the experiment stations and to widen the scope of their activities.

The appropriations provided for by the acts of Congress, which were received by 56 of the stations, amounted to $1,539,000 for the fiscal year ended June 30, 1911. The appropriations made by State legislatures for the work of the experiment stations again amounted, during the year, to over $1,000,000, and the fees received from the different kinds of inspection work, together with the amounts realized from the sales of farm products and secured from other local sources, aggregated about $500,000.

Progress was made during the year in widening the scope and increasing the efficiency of extension work. To this class of work over 100 persons are at present devoting their entire time. The organization, development, and growth of extension departments as separate branches indicate that it is realized that the stations themselves must remain true to the purpose for which they were established and for which they are maintained, namely, scientific investigations of the problems relating to agriculture.

One of the important features of the stations' work has related to dry farming, with a bearing not only upon the crops and methods of culture adapted to regions of deficient rainfall, but also upon the complex relations of water to the growth and health of plants, the nature of drought resistance, and the means of producing plants resistant to adverse climatic conditions. The California Station, among others, made notable progress in the study of the relation between the water supply of the soil and the growth and health of plants, i. e., the true duty of water in plant growth. It has been shown that, while deficiency of water retards the growth of plants, excess of water, as in careless irrigation, may seriously affect their health.

The work of the stations is emphasizing more strongly each year the fact that progress in the improvement of agricultural crops must be based upon a fundamental, scientific knowledge of the nature of the qualities it is desired to develop and perpetuate, as, for example, yielding capacity, drought resistance, disease resistance, hardiness, and the like.

The Wisconsin Station is preparing to distribute a considerable number of new varieties of plums and apples that have been developed at the station. In 1910 it distributed over 300 pounds of improved tobacco seed to growers in the State. Pedigreed barleys have been disseminated through the Wisconsin Experiment Association. The work has been extended to include boys' clubs, and contests have been arranged in growing corn, barley, and oats, $18,000 in premiums being offered in various fairs, contests, etc. The yield of a pedigreed strain of oats on the station farm is reported at 76 bushels per acre.

The plant-breeding work in the department of horticulture in the South Dakota Station has become very extensive. Some excellent hybrid plums, plum and sand-cherry crosses, and hybrids of raspberries have been given to the public, and others are receiving final trial before they are distributed. The hybrids of purple-leafed plum of Persia with the sand cherry have turned out to be valuable ornamentals, and the union of the native plum and the Chinese apricot has resulted in varieties promising as profitable market fruits. A hybrid raspberry sent out from the station is winning much favor over a wide area of the Northwest and is the hardiest raspberry so far produced. The same department is carrying on alfalfa-breeding work, in which seven or eight species of Medicago are being used, to develop hardy strains for hay, pasture, and seed production. This station is also carrying on work in the breeding of sugar beets in cooperation with this department. This work has so far resulted in more than 40 different strains of selected beets, as many more cross-bred varieties, and a number of single individuals selected on account of excellence. As a result of several seasons' work it is claimed that hybrid sugar beets have not given as good results as those developed from a process of straight selection from known mother beets. In sugar-beet breeding work carried on by the Utah Station, strict methods of pedigreed breeding are employed, and the total hereditary power of each original mother is ascertained. The seed produced last year showed a gain of over 1½ per cent in the sugar content as compared with the imported seed of the same original strain.

Many of the stations have achieved noteworthy results and observed valuable points in the improvement of field crops.

The work of the North Dakota Station in plant breeding was particularly large in breeding alfalfa, corn, and winter grains. The blue-stem wheat was largely disseminated through the demonstration farms; the result of 17 years' work was the first blue-stem seed distributed by the station. The yield at the station in the very dry year of 1910 was 27½ bushels per acre on 5 acres, while the average wheat production for the entire State was estimated at only 5½ bushels per acre. A winter rye bred by the station proved hardy to a considerably greater degree than common rye sown in the country and gave greater yields. In a similar way the development and distribution of new varieties among farms of the State was continued by the Minnesota Station. A new variety of winter wheat and three varieties of oats originated at the station, and which outyielded ordinary grains by 15 to 25 per cent, were distributed. One variety each of wheat, oats, corn, and flax originated and sent out by this station have become known commercially and are now quite widely grown in Minnesota and the adjoining States.

The increase and fixation of desirable properties in plants by the Ohio Station included work with 130 strains of alfalfa propagated from seed from as many different plants, 245 strains of red clover, 100 strains of corn, 569 strains of oats, 125 strains of soy beans, and 1,560 strains of wheat. Pedigreed strains of corn have been developed which are thus far yielding 5 to 14 bushels more than the original varieties; pedigreed strains of oats and wheat are yielding 3 to 6 bushels more than the original stock, and soy beans 2½ to 6 bushels more. It is estimated that the hybrid wheats originated and distributed by the Washington Station for the last four years resulted, in the season of 1910, in an increase of 1,500,000 bushels in the production of wheat.

Special attention is being given to problems of soil bacteriology, including the importance of humus as a medium of existence for the soil organisms which have to do with soil fertility. The Colorado Station has demonstrated the occurrence of areas of soil in irrigated orchards and sugar-beet fields containing nitrates in such excessive amounts as to destroy the crops. Apparently the excess of nitrates is due to phenomenal bacterial activity, and the problem is to devise means for the utilization of this rapid nitrate formation for beneficial purposes and to prevent it from becoming a menace to crops. The California Station in studying soil bacteria under arid conditions found nitrifying bacteria down to a depth of 12 feet, while in humus soils they occur within the first 6 inches. Results secured at the Kansas Station suggested that plowing from 8 to 10 inches deep tends to increase the number of soil bacteria in both sandy and silt soils, and also tends to increase bacterial activity. The maximum number of bacteria was found within the fifth and sixth inches of the soil. An increase in soil temperature was found to increase the activity of the bacteria and an excess of moisture to reduce their number. The Montana Station observed that where moisture content of the soil was good the nitrate formation was relatively high. In connection with these studies it was shown that the great benefit from summer fallow was due to nitrates accumulated in the moist soil during the fallow season, which gives a rapid growth the following year, so that the crop usually has advanced beyond the stage of liability to serious injury before the dry period of the year arrives.

The Utah Station in studying the formation and movement of nitrates in irrigated soils found that the nitric nitrogen tended to accumulate in the lower foot sections during winter and spring.

In a series of feeding experiments the Nebraska Station demonstrated that when corn is above 35 cents per bushel and alfalfa not over $7 per ton, the old method of fattening cattle for market, which consists of feeding heavily with grain and using little roughage, is much less profitable than a moderate use of grain and correspondingly more roughage. In a five-year trial of fattening cattle on bluegrass pasture at the Missouri Station, better gains were made and a more uniform finish was obtained when corn was substituted for either gluten, linseed, or cottonseed meal.

The Tennessee Station has worked out double cropping systems for the State under which two crops are grown on the land annually, and in that connection has been able to maintain a steer for every acre in this work.

The North Dakota Station conducted feeding experiments with hogs, in which different feeds were compared. It was found that corn produced a much larger proportion of fat than barley and in consequence made a poorer grade of pork. It required 18 per cent more of barley than of corn to produce a given gain in weight. Another test showed that ground rejected wheat produced good gains when fed to swine with shorts. In comparison with corn it required 8.9 per cent more rejected wheat than corn to produce the same gains, but the quality of pork produced was better than that produced on corn.

Several of the stations have shown that heavy feeding of silage—up to over 40 pounds a day—can be followed with advantage in fattening cattle. In one instance 3 pounds of gain a day were made in this manner, with little grain, and the beef was finely finished. In this connection it is worthy of mention that a number of stations have given considerable attention to silo construction. The Iowa Station has designed a silo built of hollow tile, reenforced between courses of blocks, which is proving very efficient and cheaper in construction than concrete where sand and gravel have to be shipped in.

In testing different methods of preparing corn for hogs, the Iowa Station found that the most satisfactory results were secured from feeding dry ear corn until the hogs weighed about 200 pounds. For heavier hogs soaked shelled corn gave the most economical gains of all the forms in which corn was fed. In experiments in hogging down corn this station has produced pork at less than 3 cents a pound.

At the New York Cornell Experiment Station it was found that mangels raised at a cost of $4 per ton and judiciously used to take the place of one-half of the grain ordinarily fed are profitable in feeding the dairy cow.

The results of shelter experiments conducted at the Pennsylvania Station showed that steers fed in an open shed on succulent rations, including silage, made more rapid and cheaper gains and attained a higher finish than similar cattle fed in the same way in the basement of a barn.

Along horticultural lines studies at the Missouri Station on the dormant period of plants have shown that hard freezing or severe drought will force the development of buds, and that anything that will delay ripening will cause a prolonged resting period. Late growth due to fertilizing and cultivation has resulted in heavy crops of fruit where frosts destroyed those in orchards which were permitted to mature in a normal manner. Peach trees pruned according to the methods advocated by the station were made to produce two additional crops in eight years. Last year the Jonathan apple orchard on the horticultural grounds returned over $300 per acre, while unsprayed Jonathan apples in the neighborhood had almost no marketable fruit. In a demonstration experiment a sprayed acre of Jonathan apples in a commercial apple orchard produced more marketable apples than the remaining 139 acres which were not sprayed.

The Arizona Station has worked out two methods of artificial ripening of dates, which will largely overcome the failure of the fruit to ripen sufficiently early and its tendency to sour in damp weather during the ripening period. One method depends upon stimulation of the ripening process by chemicals at ordinary temperatures; the other method consists in heating under controlled conditions of moisture. Both methods are practiced and give a finished product of high quality. The Arizona Station now recommends the planting of Deglet Noor palms in the Salton Basin, along the lower Colorado, and in southern Arizona up to the altitude of 1,200 feet.

After experimenting with orchard fertilizers for 15 years, the New York State Station has concluded that commercial fertilizers are of little benefit to young apple orchards growing on soils naturally suited to apple culture, provided the orchards are well tilled, well drained, and properly supplied with organic matter from stable manure or from cover crops.

The entomologist of the Kansas Station has demonstrated the practicability of high temperatures as an efficient method of control of insects in stored grains. The method has been successfully installed in several mills in the State. He has also shown that the chinch bug winters in bunch grasses in Kansas, and that burning over these areas materially reduces the attack of the chinch bug the next year. In connection with inspection work carried on in cooperation with the State horticultural department and provided for by the State horticultural law, the Maryland Station discovered over 700 nests of the brown-tail moth in imported nursery plants and destroyed them to prevent distribution.

The New Hampshire Station demonstrated the possibility of controlling the black fly in the White Mountains by treating streams where these flies breed with a suitable soluble oil, which kills the larvæ without injury to the trout in the stream.

The veterinary department of the Delaware Station, in cooperation with the Bureau of Animal Industry of this department, has produced a serum with which sheep may be protected against an otherwise mortal dose of anthrax bacilli and an immediate passive immunity produced. In an investigation of the strongyloid parasites of calves the South Carolina Station has found that their attack may be avoided by keeping animals on other than low, moist pastures.

The Minnesota Station reports in its studies on stable ventilation that the relative percentages of oxygen and carbon dioxid do not seem to be of material effect, but that the confined air seems to influence the kidney secretions. It was observed during the year that pigs from immune sows appear to be born with very high resistance to cholera. This natural immunity was found to disappear gradually, but was sufficient up to at least 5 weeks of age to make it possible to inoculate such pigs with very high virulent blood with an unimportant percentage of loss.

The California Station found that under California conditions the use of bovo-vaccine seemed to produce some immunity against tuberculosis but to fail in protecting calves until 2½ years old. It was also found that tuberculosis spreads rapidly in cattle under strictly outdoor conditions.

The dairy expert of the New York Cornell Station in his work with the milking machine found that immersion of the milking parts of the machine in a 10 per cent solution of common salt between milkings was more efficacious than steaming. The germ content of the milk was found to be determined largely by the efficiency of the air filters of the machine.

The principles underlying the making of ice cream and the factors which influence the process and the product were studied extensively at the Vermont Station, and an epoch-making bulletin was issued on the subject. The Iowa Station published a bulletin on a new and healthful frozen dairy product worked out by the dairy department of the station, and named lacto.

In the Eastern States the work of the stations continues to indicate the advisability and practicability of growing alfalfa in many sections. Last year the New Jersey Station's alfalfa field of 10 acres, seeded the year before, produced a total of 60 tons of hay. The New York Cornell Station in studying the relation of lime to the growth of this crop found that the protein content of alfalfa grown on lime soil is markedly greater than that of plants grown on soil in need of lime. In the particular experiments the difference amounted to 88 pounds of protein per ton of alfalfa hay. It was also observed that the growth of alfalfa increased the nitrifying power of the soil for at least certain periods in the growth of the crop.

The Nebraska Station, in studies of the water requirements of plants by a new method perfected by the station, has found in two dry years that there was a distinct economy of water with narrow-leaved corn as compared with broad-leaved. The strains with a high leaf area yielded 43.6 bushels per acre, while those with a low leaf area produced 52.1 bushels. The Delaware Station states that a fall growth of crimson clover may furnish 50 to 100 pounds of nitrogen per acre and be profitable even though the crop is winter-killed, and that the first month's growth in the spring usually produced about one-third of the total yield of nitrogen. It was determined that when the crop was removed 35 to 40 per cent of the nitrogen was left in stubble and roots.

The New Jersey Station has worked out a bacteriological method of determining the availability of nitrogenous fertilizers which promises to be of great practical value. It is based upon the rapidity with which the nitrogen of such fertilizers is converted into ammonia by bacteria.

THE AGRICULTURAL COLLEGES AND SCHOOLS.

The promotion of agricultural education has become a world-wide movement. There is now scarcely a civilized country in which no provision is made for specific practical instruction in agriculture, and wherever governments are establishing universities they are providing as liberally for colleges of agriculture as for those of the liberal arts and the professions. In this country many of the State universities are indebted largely to their colleges of agriculture for their present liberal support and large attendance of students, and some of them have actually grown within a few years from small land-grant colleges to large State universities.

The past year has been one of the best in the history of the American agricultural colleges. They have had more liberal appropriations from their respective legislatures and a larger attendance of students than ever before, and more of them have made provision for reaching the farmer and his wife and children upon the farm through the establishment of extension departments and the maintenance of training courses in agriculture for public-school teachers. Such courses were maintained in at least 46 of the agricultural colleges, and in 22 of them regular four-year courses for teachers were offered.

The success of the agricultural colleges and their efforts for the development of other educational agencies for the farmer have resulted in the very rapid growth recently of secondary schools of agriculture and of departments of agricultural instruction in public high schools. Several of the States have established complete systems of agricultural high schools, while others have adopted the policy of giving bonuses to existing high schools to encourage the establishment and proper support of agricultural instruction. During the year the legislatures in Maryland, New York, North Carolina, and Wisconsin passed laws providing for State aid for such high-school departments, and Minnesota and Virginia increased the amount of money available for such purposes. Minnesota now provides $2,500 for each of 30 high-school departments of agriculture, home economics, and manual training, and $1,000 for each of 50 other such departments. There are 10 States that give aid for high-school departments of agriculture.

In an advisory capacity this department is aiding the State authorities in the promotion of agricultural education by maintaining in the Office of Experiment Stations a small agricultural education service, which studies the various systems of agricultural education, investigates methods of teaching agriculture, prepares publications for teachers and others interested in promoting the educational efficiency of the people living in the country, brings the large amounts of new information on agricultural subjects published by the department and the experiment stations to the attention of teachers and students, and in general acts as a clearing house for agricultural education in this country. In this way 22 different States were given special assistance during the year.

FARMERS' INSTITUTES.

The work of the department in aid of farmers' institutes has continued under the direction of the Office of Experiment Stations. The reports of the several States show that during the year 5,712 regular institutes were held, consisting of 16,578 half-day and evening sessions, with an attendance of 2,094,155. Special institutes, movable schools, railroad specials, and other forms of agricultural extension had an attendance of 1,323,793, making the total attendance upon all forms of institute activity 3,417,948, an increase of 484,704 over that of the previous year.

THE DEPARTMENT'S INSULAR AGRICULTURAL EXPERIMENT STATIONS.

An eminently successful year has been reported by the stations maintained by the department in Alaska, Hawaii, Porto Rico, and Guam. The energies of these stations continue to be directed toward the diversification and improvement of the agriculture of their respective regions. These represent the widest extremes of agricultural conditions, from the arctic agriculture of Alaska to the tropical conditions of Hawaii, Porto Rico, and Guam, and present agricultural possibilities of the greatest diversity. That these stations are growing in the esteem and confidence of the people for whom they are maintained is shown by the rapid growth in correspondence, in the demand for publications, and in individual requests for advice as well as in the readiness to engage in cooperative work of all sorts and the increasingly generous private and community contributions of funds. The scientific work of these stations is attracting wide attention; their publications are noted in the principal scientific review journals of the world, and in not a few instances have been republished in foreign countries.

Through local contributions several additions have been made to the cooperative demonstration farms maintained by some of the stations. These farms will furnish the means of demonstrating the more practical results of the stations' work, while the more technical experiments are carried out at the station proper.

THE ALASKA STATIONS.

The work at the agricultural experiment stations in Alaska has been carried out during the year in accordance with the plans outlined in former reports. At Sitka horticultural and plant-breeding work is given prominence. At Rampart the principal work is in testing and breeding varieties of grain and in experiments with potatoes and hardy leguminous plants. Farming on a commercial scale as it must be practiced by settlers is carried on at Fairbanks, and at Kodiak breeding and care of live stock are the principal investigations. For the present this work is confined to cattle and sheep. The work with hybrid strawberries at Sitka has been continued with marked success and this station continues to propagate and distribute for trial a large number of fruit trees and bushes, and some ornamental plants. Comparative tests of about 60 varieties of potatoes, and of many varieties of cabbage, cauliflower, and other vegetables are being continued at the Sitka station to determine which varieties are best adapted to the climatic conditions of the coast region.

At the Rampart Station efforts to grow barley and oats have been uniformly successful and a number of crosses of varieties of barley have been made, some of which appear to have desirable qualities. Most of the spring-sown grains matured their crops this year. Some of the winter grains were partially destroyed by hard freezing before the ground was covered with snow. Potatoes have also been grown with success at this station. At the Fairbanks Station an attempt is being made to grow grain, hay, and potatoes on a commercial scale, but up to the present the principal energies have been expended in extending the area of cultivable land, about 70 acres being now under the plow. In 1910, in spite of injury to the plants by frost, several hundred bushels of potatoes were produced, of which $1,500 worth was sold. At the Kodiak Station, which is devoted mainly to animal production, 82 head of purebred Galloway cattle of all ages, 10 grade cattle, and 89 sheep and lambs were successfully wintered on native forage supplemented by a small amount of purchased grain feed, and there does not appear to be any reason why stock raising should not be made a success in the coast region of Alaska, if care is exercised in selecting the stock and keeping it well housed and fed during the winter.

THE HAWAII STATION.

At the Hawaii Station the investigations outlined in previous reports have been continued and a number of new lines of work have been begun. The work with cotton continues to attract favorable attention, and it would seem that the profitableness of this new agricultural industry has been demonstrated. The Japanese rices imported by the station have been successfully grown, and samples submitted to rice consumers have been pronounced equal in quality to the imported Japanese rice. The importance of this fact is apparent when it is known that one-half to 1 cent per pound more is paid for Japanese than for other rice. Fertilizer experiments with rice and taro have given results which show how important improvements may be made in the methods of fertilizing these crops. In continuation of the work with pineapples, it has been shown that the chief difficulties with this crop are due to a lack of drainage and in certain restricted localities to too much manganese in the soils. It has also been found that pineapples can be profitably grown in Hawaii with less rainfall than has hitherto been thought necessary. Experiments with broom corn at the station were so successful that this crop is being planted to some extent and a broom factory has been established in Honolulu. The station has carried on a number of experiments with various tropical fruits, and among other things has worked out a very successful budding method for avocados, has demonstrated the possibility of the orchard production of the papaya, and has aroused interest in improved methods of banana culture. In view of the shortage of forage in the islands the station is encouraging the culture of forage plants, especially with reference to ranch conditions. During the year the station established with Territorial funds 3 demonstration farms, 1 on Kauai and 2 on Hawaii. Similar farms are to be established elsewhere.

THE PORTO RICO STATION.

The Porto Rico Station has made substantial progress during the year both in equipment and in lines of work, and there is evidence that the relations of the station with the people of Porto Rico are most satisfactory. In accordance with the terms of the last appropriation act, coffee investigations were made a more extensive part of the station work during the year. The introduction of the higher-priced coffees into Porto Rican culture has been continued and some of the Java varieties are coming into bearing. Some 3-year-old trees have borne at the rate of 800 pounds merchantable coffee per acre, while the average of the island is only about 200 pounds per acre. Considerable attention has also been given to the study of the means of control of various insects and diseases to which the coffee plant is subject. The horticultural work of the station was considerably extended and included investigations on grafting stocks, fertilizers, and cover crops for citrus fruits. Especial attention was given to the introduction and propagation of the better varieties of mangoes, more than 40 varieties having been introduced from various tropical countries. The work in animal husbandry was also broadened and now includes horse breeding to improve the size and conformation of the horse, breeding for work oxen and dairy cattle, as well as the introduction and breeding of hogs, sheep, and poultry. Preliminary investigations on the production of forage have been begun, and a variety of sorghum introduced from Barbados has given heavy yields on dry, hilly lands. The work in making and feeding silage was continued, and it appears that good silage can be made with less difficulty in Porto Rico than in a temperate climate. An investigation showing that chlorosis in pineapples, which prevails in the island, is due to an excess of carbonate of lime in the soil was completed during the year. This work furnishes a valuable basis for the selection of soils for pineapples.

THE GUAM STATION.

Although much of the work done at the Guam Station during the year was of a preliminary character, such as the construction of new buildings, building of roads, clearing and draining of lands, etc., various field operations were also successfully carried on. The leading work of this station continues to be the production of feed and forage preliminary to experiments on the improvement of the live stock of the island and includes experiments with corn, various grasses, and leguminous forage plants. The experiments have demonstrated the superior value of Para grass, *Paspalum dilatatum*, Guinea grass, and several nonsaccharin sorghums as forage plants. Of the leguminous plants under observation, the pigeon pea, jack bean, and common peanut have given promise of success. Much work was carried on with vegetables, in many cases with very promising results. One of the most striking achievements of this station is the introduction of the Smooth Cayenne pineapple from Hawaii. Various other fruits besides a number of miscellaneous plants have been introduced and are being tested by the station. Plans have been perfected for undertaking experiments on the improvement of the live stock of the island, which is now of very low grade, and 6 head of Morgan horses, 5 of Ayrshire cattle, 4 Berkshire hogs, and some poultry were shipped to Guam by Government transport in September. There is a growing interest in the work of the station, which has been greatly promoted by the cordial cooperation of the local authorities.

DESIRABILITY OF ESTABLISHING STATION AT TUTUILA.

The attention of the department has been called by the naval Governor of Tutuila to the desirability of establishing an agricultural experiment station on that island. This and the adjoining Manua Islands of the Samoan group came into the possession of the United States in 1899. The people are mainly engaged in agriculture, copra, the dried flesh of the coconut, being their only marketable product. The coconut beetle, a very destructive pest, is said to be present on neighboring islands, and its appearance on Tutuila would probably be followed by the destruction of the copra industry so far as that island is concerned. The establishment of an experiment station with men trained along the lines of modern agriculture would aid materially in preventing its introduction and also would demonstrate the advantages of more diversified agriculture.

IRRIGATION INVESTIGATIONS.

The Office of Experiment Stations has maintained its former lines of irrigation investigations with such modifications as have been necessary to best meet the changing conditions and the new problems. The work has been conducted chiefly along three lines: (1) Investigations and experiments to ascertain better methods of applying water and of preventing wastes through seepage, evaporation, and overapplication, to determine the effects of irrigation upon the yield and quality of crops, and to obtain data as to power and pumping; (2) the collection of data and publication of bulletins and circulars on methods of applying water to different crops, the irrigation possibilities and conditions in different sections of the arid West, and pumping; (3) the furnishing of prospective settlers with information concerning different localities and advising new and old settlers in irrigated sections in regard to the methods best adapted to their individual needs and how best to use their water supplies. This last line of work has occupied the greater part of the time of the 10 agents of this office detailed to have charge of the work in the various Western States and Territories.

The investigations and experiments regarding seepage from canals, evaporation from irrigated soils, and the most economical amount of water to use on different crops in different localities have all been continued and have had a noteworthy effect in reducing the losses of water due to the wasteful methods too commonly practiced. The demonstration farms at Davis, Cal.; Gooding, Idaho; Cheyenne and Newcastle, Wyo., and Eads, Colo., have also exerted a great influence by giving irrigators of those sections actual demonstrations of the best methods of applying water.

DRAINAGE INVESTIGATIONS.

Among the most important drainage investigations of the year have been those pertaining to the reclamation of tidal marshes. The growing population and the scarcity of good upland farms, particularly in the Atlantic Coast States, have caused search to be made for any uncultivated lands that could be made profitable for agriculture. It is not surprising, in view of the richness of European lands reclaimed from the sea, that attention early turned toward the salt marshes. On account of the interest aroused in this work, a thorough investigation has been made by this office. Four large tracts of drained tidal marsh on the Delaware River have been minutely studied, with the view of determining the kind of marsh lands that might be profitably reclaimed, the special requirements of the protective and drainage works, the causes of past failures, the treatment of the soil to fit it for dry-land crops, the kind of crops best suited to newly reclaimed marshes, the cost of reclamation, and the profitableness of the reclamation. Very full data were obtained on nearly all these points. The investigations along the Delaware River were supplemented by examinations of reclaimed lands on the coast of New England, Nova Scotia, and New Brunswick.

NUTRITION INVESTIGATIONS.

In continuing studies of the nutritive value of animal and vegetable products used as food, attention has been directed particularly to two lines of work, namely, the use of cheese and other materials as possible substitutes for meat in the diet, and the adaptation of the respiration calorimeter to studies of physiological changes in vegetable products, particularly with reference to the changes which bananas undergo during the active ripening period.

The work with cheese and other meat substitutes has involved respiration calorimeter experiments on the relative ease of digestion of cheese and meat, as well as more practical experiments, the general conclusion being that if a housekeeper so desires it is possible to prepare a well-balanced dietary in which cheese and other foods may be used wholly or in part in place of meat. The question has been discussed at length in an article in the Yearbook, while much related information on the use of cheese in the diet has been prepared for publication as a Farmers' Bulletin.

Particularly interesting is the adaptation of the respiration calorimeter to the study of problems of vegetable physiology, and the results obtained in a series of experiments carried on in cooperation with the Bureau of Chemistry on the respiration and energy output of bananas during the active ripening period. Not only have the results provided facts of great value in connection with studies of ripening fruit which the department is carrying on, as well as facts of theoretical interest, but they have also shown that the respiration calorimeter offers a new means for studying problems of vegetable physiology which are of great importance to the producer and shipper of agricultural products, the warehouseman, and those who store products in the home, as well as to the student interested in the study of technical questions.

OFFICE OF PUBLIC ROADS.

THE EVOLUTION OF THE ROAD PROBLEM.

The United States is in the midst of a national readjustment with regard to road improvement. The rapidly changing traffic conditions have necessitated equally radical departures from the old methods of road construction and maintenance. Methods which but a few years ago were considered entirely satisfactory and firmly established, both in theory and practice, are now often found to be entirely inadequate. In road administration the old principle of extreme localization is fast giving way to new systems involving the principle of centralization and fixed responsibility. A great deal of careful scientific, as well as educational, work is needed in order to solve correctly the many difficult problems which have arisen in regard to the administration, construction, and maintenance of our public roads. This work should prove of the greatest value to the whole country.

OBJECT-LESSON AND EXPERIMENTAL ROADS.

The questions which confront road builders vary greatly with local conditions. Instruction in the art of road building to be of real practical value must be adapted to the peculiar conditions of each locality. Such instruction is given by the Office of Public Roads through the medium of object-lesson roads, built at local expense. During the past fiscal year roads were built in 52 places, involving an expenditure of approximately $120,000 by the local authorities. The types of road construction included sand-clay, earth, gravel, oiled gravel, plain macadam, bituminous macadam, oil concrete, and slag asphalt. When it is considered that each of these 52 object-lesson roads constitutes a practical school of applied road building, it must be evident that this feature of the department's work is a powerful factor in the great Nation-wide movement for the betterment of our public roads.

ADVISORY WORK.

For the purpose of giving expert advice concerning specific problems in road work 183 special assignments covering 30 States were made. This work related to such varied subjects as construction of various types of road, surveys, use of prison labor in road work, bridge construction, road maintenance, use of the split-log drag, road materials, effect of automobiles on roads, issuance of bonds for road improvement, road drainage, and other work along similar lines. This is most positive evidence of the wide usefulness of this office, and shows also how generally local communities have come to look upon the Office of Public Roads as a body of consulting engineers and experts capable of offering effective and reliable advice concerning difficult and special problems which are not easily handled by the local authorities.

MODEL SYSTEMS.

Work under the project of model systems has shown a most wonderful increase during the year. Assistance along these lines has been given to 14 counties in 8 States, as against 3 counties in 1910. This is work of the most useful and permanent character. It involves a thorough investigation of the entire road system of the county with regard to location, materials, systems of construction, maintenance, and administration. In fact, every feature bearing on the practical improvement and future maintenance of the roads of the county is considered, and a practical working scheme for the present as well as future betterment and maintenance is drawn up and given to the proper authorities.

LECTURES, ADDRESSES, AND PAPERS.

Lectures, addresses, and papers form an important part of the educational work of the Office of Public Roads, which has been greatly increased during the year. These lectures are in almost all cases given by the men who direct the investigative work and the construction and maintenance of the object-lesson roads, and are therefore of a practical and instructive character. During the year 723 lectures and addresses were given in 35 States, as compared with 523 for the previous year. These lectures had a total attendance of over 200,000, a large majority of whom were farmers.

INSTRUCTION IN HIGHWAY ENGINEERING.

The project for the instruction of engineer students in practical methods of road construction and maintenance has been enlarged and improved during the year. The plan provides for the appointment each year of graduate engineers to the position of civil-engineer student. The course of instruction covers one year, during which the student receives a most thorough training in all branches of the work. The Office of Public Roads is in constant receipt of requests from States, counties, and townships to recommend competent young engineers to take charge of road improvement. During the year 12 engineers, constituting a very considerable percentage of the total number, resigned to take up work in various parts of the country. While the work of the office is to a certain extent handicapped by this constant drain, it is believed that the benefit derived by the country in general through the distribution of properly trained highway engineers in the various States and counties is so great as to vindicate the wisdom of this project. While the object-lesson work is an excellent example in any community, it lacks the living, dynamic force which the capable, progressive engineer exerts continually from year to year on the movement for better roads in all of its varied phases.

HIGHWAY BRIDGES AND CULVERTS.

During the year a bridge section has been established in the Office of Public Roads. The need for better culverts and bridges for our public highways is becoming evident from the point of view both of economy and of safety. One of the peculiar difficulties encountered by the local communities with regard to bridges and culverts is that the great majority of these structures are comparatively small, so that those in responsible charge do not feel warranted in incurring the expense incident to the employment of skilled engineering assistance. Requests are continually being received for information concerning the use of concrete and other materials for bridges and culverts. Such information is being collected and disseminated. One bulletin dealing with this subject has already been published and others are in course of preparation. The published information is supplemented by personal inspection, advice, plans, and superintendence by the engineers of the office when request is made through the proper local authorities.

TESTING OF ROAD MATERIALS.

In the routine testing and examination of road materials great progress has been made along established lines. The total number of samples tested during the year was 685, which were received from a widely distributed area, including 42 States and Territories, Porto Rico, Canada, and Germany. During the year 324 samples, mostly bitumens, were received for examination in the chemical laboratories. This is nearly twice the number examined during the previous year, and more than four times the number examined in 1909. Much valuable work has also been done in standardizing methods of testing and examining road binders and other materials. It has been found that the addition of a small proportion of cement to blast-furnace slag screenings increases the cementing properties very greatly. These investigations will be continued both in laboratory studies and in service experiments in the field during the coming year. Research work in concrete has been carried on with increased vigor. These investigations include a study of oil-mixed cement concrete, principally with reference to its road-building and water-proofing properties, and also a study of the expansion and contraction of concrete while hardening, a subject of much importance in connection with concrete pavements.

INVESTIGATION OF ROAD BINDERS AND DUST PREVENTIVES.

Investigation of the problems of dust prevention and road preservation has occupied much attention during the year. Commendable progress has been made in the several lines of work. Demand for specifications covering the various types of bituminous binders and bituminous road construction is continually increasing. During the year 81 sets of specifications were furnished, on request, to officials in 20 different States, and also to the Reclamation Service, the Navy Department, and the War Department.

Many worthless road preparations have been and are still being manufactured and sold to the public through ignorance on the part of both the producer and consumer with regard to the characteristics of such materials requisite to meet local conditions. These materials are sold under trade names, and as a rule carry no valid guaranty of quality. Correct specifications for such materials are, therefore, much needed for the protection of the public.

The influence of the work already done by the office along these lines is shown in the production of better and more uniform materials on the part of the manufacturers.

While great progress has been made in the improvement of methods of bituminous road treatment and construction during recent years, the subject is still in a stage of development. For this reason the work carried on by the office is of the greatest value to the country in general. Tests and methods of analysis are being standardized, and the behavior of the various materials in actual use is being more definitely determined, while the development of economic and practical methods of construction suitable for various local conditions is being perfected. Much research work along these lines has also been carried on, and will be continued during the coming year. These cover such subjects as the effect of various methods of distillation on the physical and chemical properties of tars, investigations on the economic utilization of various coke-oven tars in the preparation of road binders, studies on the effect of light and the effect of weathering on various bituminous materials, and other allied subjects.

STATISTICAL AND ECONOMIC INVESTIGATIONS.

An investigation completed during the year shows that the total road mileage of the United States, exclusive of Alaska and insular possessions, is 2,210,857 miles, of which only 187,910 miles, or 8.49 per cent of all our roads, are improved. But in 1904 only 153,531 miles, or 7.13 per cent of our public roads, were improved. Thus in the five-year period 1904–1909 the increase in the mileage of our improved roads has been 34,379 miles. Investigations to ascertain the economic effect of road improvements on rural communities were begun in 1910 and carried on during the past year. These investigations give promise of exceedingly valuable data and will be continued during the coming year. Investigations dealing with road administration and road management have been inaugurated during the year. It is believed that when these investigations are completed and published they will result in the complete reorganization of the present system of road administration in many communities throughout the country. Information is also being collected in regard to taxation, bond issues, and the use of convict labor in road building. This work will be continued during the present year.

EXHIBITS AND ROAD-IMPROVEMENT TRAINS.

Another important feature of the educational work of the office during the year was the road exhibits displayed at Knoxville, Tenn., during the Appalachian Exposition, and also at Chicago, Ill., during the National Land and Irrigation Exposition. These exhibits attracted so much attention at these expositions that various railroad companies applied to the office for the privilege of installing them on cars where they could be shown at the principal towns along their lines. An arrangement was accordingly made with the Pennsylvania Railroad, the State Highway Department of Pennsylvania, and the Pennsylvania State College to cooperate with the office in operating a road-improvement train throughout the State of Pennsylvania. The train carried an exhibit car, which contained not only the models referred to above, but also a large number of enlarged photographs and pictures illustrating various features of the road subject, together with a lecture car, in which illustrated lectures were given at each stopping place. Two other cars were provided with exhibits of modern road-building machinery. Another similar train was started May 1, 1911, over the lines of the Southern Railway. The success of this project is shown by the fact that during the year approximately 65,000 people attended the lectures and viewed the exhibits. This work will be continued along similar lines during the coming year.

OIL-MIXED CEMENT CONCRETE.

A very important discovery, that of oil-mixed cement concrete, was made during the fiscal year 1910. Laboratory and service investigations show that the Portland cement concrete of everyday use may be rendered waterproof at very slight extra cost simply by the addition of residual mineral oil. The possibilities for an increased and more efficient usefulness of concrete by the application of this method of damp-proofing are manifestly numerous.

A public patent, which has aroused much interest throughout the country, has been granted to Mr. L. W. Page, Director of the Office of Public Roads, for mixing oil with Portland cement concrete and hydraulic cements giving an alkaline reaction, so that anyone may use this process without the payment of royalties.

The crop year 1911 has been one of extremes. Light rainfall and high temperatures reduced the magnitude of many of our crops, and this reduction increased the price. The cotton crop was above the average and its price declined heavily.

The study of agriculture is progressing along scientific and practical lines and the work done indicates better mental equipment.

While the total values of crops in 1911 are not so high as in 1910, there is great abundance for all purposes. I am gratified to see the beet-sugar tonnage reach nearly the 600,000 figure. It indicates that we can make our sugar. We still buy nearly $100,000,000 worth of sweetening.

Respectfully submitted.

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *November 25, 1911.*

SEAMAN ASAHEL KNAPP.

By Beverly T. Galloway,
Chief, Bureau of Plant Industry.

Seaman Asahel Knapp (see frontispiece) was born at Schroop, Essex County, N. Y., December 16, 1833, and died in Washington, D. C., April 1, 1911. He received his early education at select schools and at the Troy Conference Seminary, located at Fort Edward, N. Y. After finishing at the seminary he entered Union College, at Schenectady, N. Y., from which he graduated with the degree of A. B. in 1856. From that time until 1863 he was engaged in educational work. At first he was professor and associate president of the Troy Conference Seminary, and later he was associated in the management of what was known as the Ripley Female College, located at Poultney, Vt.

Through an injury received in the early sixties, Dr. Knapp's health became much broken, and he was advised to seek another climate. In 1866 he moved west and settled on a farm in what was known as Big Grove, Benton County, Iowa, not far from Vinton, the county seat. His health continuing poor, he was compelled to move to Vinton but still retained his farm. In 1869 he was elected superintendent of the State College for the Blind, located at that place. In 1874 he resigned this position and again engaged in farming. He began the raising of general crops together with live stock, principally Berkshire hogs and Shorthorn cattle, and was a member of the first Iowa Fine Stock Breeders' Association.

In the latter part of the seventies Dr. Knapp began, in Cedar Rapids, Iowa, the publication of a farm journal known as "The Western Stock Journal and Farmer." Through the medium of this paper and in other ways he pointed out to farmers the importance of producing more stock and the necessity of getting away from the one-crop idea. About this time he became acquainted with James Wilson, the present Secretary of Agriculture, who was then engaged in farming in Tama County.

In the fall of 1879 Dr. Knapp was elected professor of agriculture at the Iowa State Agricultural College, as it was then called, located at Ames, Iowa. In 1884 he was elected president of the college.

During his term of office there was established for the first time in the history of the institution a course in agriculture, and the first graduates in agricultural classes finished their course during Dr. Knapp's incumbency. A number of men who graduated during his term of office have become prominent in the agriculture of this country.

In 1886 Dr. Knapp resigned the presidency of the college and went to Lake Charles, La., to accept a position in connection with a large corporation engaged in the agricultural development of the southwestern part of Louisiana. This whole region at that time was one vast cattle range, and very few crops were grown. Dr. Knapp saw and appreciated the possibilities of the country and began in an energetic way to call the attention of the northern people to the region. In this work he was very successful, thousands of families moving down from the States of Iowa, Illinois, and Indiana and taking up farms, which resulted in the development of prosperous communities.

Dr. Knapp made a feature of rice growing, extending his work in this field into Texas and other adjacent States. He was engaged in work of this character for nearly 12 years, in the meantime doing much to advance agriculture by assisting at farmers' institutes, writing many agricultural articles, and organizing societies and associations, all with the object of advancing the farmer.

The rapid development of the rice industry in southern Louisiana and Texas brought about the need for improved varieties, especially in connection with milling operations. With a view to helping the rice farmers, Dr. Knapp was authorized by Secretary Wilson in 1898 to visit Japan, China, and the Philippine Islands as an agricultural explorer for the purpose of securing all available information regarding rice varieties, rice production, and rice milling. The result of this work was the introduction of Japanese rice and a number of improvements in growing the crop which have been instrumental in greatly enlarging the rice industry. After his return much attention was given to building up the rice work, organizing the rice farmers, developing the mills, and in this way increasing the wealth of the region.

Dr. Knapp was for a number of years president of the Rice Growers' Association of America. In 1901 Secretary Wilson again sent him to the Orient for the Department of Agriculture, and in 1902 he was sent to Porto Rico to make a special report with regard to the agricultural resources of that island.

In all of his earlier work in the South Dr. Knapp recognized the great importance of diversification, and about 1902 his ideas in this direction began to crystallize. In conjunction with the writer several visits were paid to the Gulf States with a view to inaugurating a line of work looking toward the encouragement of diversification.

As a result of this effort a number of demonstration farms were established, the plan being to use these farms for the purpose of illustrating what could be done in growing crops other than cotton.

In 1903 the Mexican cotton boll weevil began to attract widespread attention in the South, and despite all that had been done it was seen that heroic efforts would be necessary to allay the fears of the farmers, especially those in Texas, whose crops had for one or two years been practically destroyed by the pest. In the fall of 1903 the writer, in company with the honorable Secretary and Dr. Knapp, visited the region infested by the weevil and after thoroughly canvassing the situation it was determined to request an appropriation of $500,000 to meet its ravages. The sum of $250,000 was finally appropriated for the purpose, half of which was placed at the disposal of the Bureau of Entomology and half assigned to the Bureau of Plant Industry.

In the light of the former work of Dr. Knapp in the South it was decided that he should have charge of an important branch having for its object the bringing home to the farmer on his own farm information which would enable him to grow cotton despite the presence of the weevil. Thus was inaugurated the Farmers' Cooperative Demonstration Work, with Dr. Knapp in charge. It was announced at the time that the object and scope of the work would be to show by actual demonstrations on the farmer's own farm the value of better cultural methods, the value of good seed, and the value of practicing a few simple principles in growing a crop of cotton despite the weevil. It was further pointed out that to carry on this work thoroughly and effectively would require a corps of men familiar with cultural conditions in the South and who would have the knowledge and ability to so direct it that the farmer would learn the great lesson of how to help himself. The methods were rapidly crystallized and simplified and have been applied in practically all the Southern States. At the inception of the work Dr. Knapp had but few assistants, but under his able management additional funds were secured and at the time of his death, in April, 1911, hundreds of experienced agents were employed, scattered throughout the South from Virginia to Texas. So great has been the recognized benefit of this work that funds from many other sources than that of the Government have been contributed. From the beginning of the work until the day of his death, Dr. Knapp kept in close touch with every phase of it. He was the leading spirit and inspiration at all times.

Dr. Knapp began his great work at an age when most men are thinking of retiring from active business, and he did so, not because of any personal advantage which might accrue, but solely because of his great desire to see southern agriculture occupy the position to which it is justly entitled. In his death the South has lost one of its most useful and sincere friends, who sacrificed ease and comfort in order that he might help to work out the serious problems confronting the farms of that region.

Numerous messages and resolutions of condolence and sympathy have been received by his family. Among the organizations which have forwarded such resolutions may be mentioned the Committee on Agriculture of the House of Representatives, the Rice Association of America, the United Agricultural Board of Virginia, and the North Carolina College of Agriculture and Mechanic Arts.

OUR MID-PACIFIC BIRD RESERVATION.

By HENRY W. HENSHAW,
Chief, Bureau of Biological Survey.

THE NEED FOR BIRD RESERVATIONS.

The spread of civilization and the utilization of wild lands, added to the destruction of animals for food, adornment, clothing, and sport, threaten the very existence of many species of native birds and mammals. The necessity of regulating the killing of game was perceived early in our colonial history, and even the need of caring for our insectivorous birds found recognition about 1850. Only in comparatively recent years, however, has the importance been recognized of protecting the large class of birds which, although they do not destroy insects or other creatures inimical to agricultural interests, are nevertheless worthy of preservation because of their beauty, grace, and harmlessness. If such birds add nothing to our material wealth, they beautify the world and greatly increase the joy of living.

Though by no means the first to recognize the importance of protecting its wild life, the United States has taken a leading place among the nations of the world in this respect. One of the most efficient of the conservation measures adopted by the Government is the setting apart here and there of islands and sterile tracts of land, worthless for other purposes, upon which our native wild birds and mammals may live and perpetuate their kind for the pleasure and profit of our own and future generations.

NUMBER OF BIRD RESERVATIONS.

The National bird reservations under the care of the Department of Agriculture already number 51 and play a very important part in the preservation of our wild game and birds. One of the most unique and interesting of these is the Hawaiian Islands Bird Reservation in the mid-Pacific (fig. 1), which, at certain seasons of the year, harbors millions of sea fowls that repair thither to establish rookeries and rear their young. The following is the executive order setting apart this refuge:

EXECUTIVE ORDER No. 1019.

It is hereby ordered that the following islets and reefs, namely: Cure Island, Pearl and Hermes Reef, Lysianski or Pell Island, Laysan Island, Mary Reef, Dowsetts Reef, Gardiner Island, Two Brothers Reef, French Frigate Shoal, Necker Island, Frost Shoal and Bird Island, situated in the Pacific Ocean at and near the extreme western extension of the Hawaiian Archipelago between latitudes 23° and 29° north, and longitudes 160° and 180° west from Greenwich, and located within the area segregated by the broken lines shown upon the diagram hereto attached and made a part of this order, are hereby reserved and set apart, subject to valid existing rights, for the use of the Department of Agriculture as a preserve and breeding ground for native birds. It is unlawful for any person to hunt, trap, capture, wilfully disturb, or kill any bird of any kind whatever, or take the eggs of such birds within the limits of this reservation except under such rules and regulations as may be prescribed from time to time by the Secretary of Agriculture. Warning is expressly given to all persons not to commit any of the acts herein enumerated and which are prohibited by law.

This reservation to be known as the Hawaiian Islands Reservation.

THEODORE ROOSEVELT.

THE WHITE HOUSE, *February 3, 1909.*

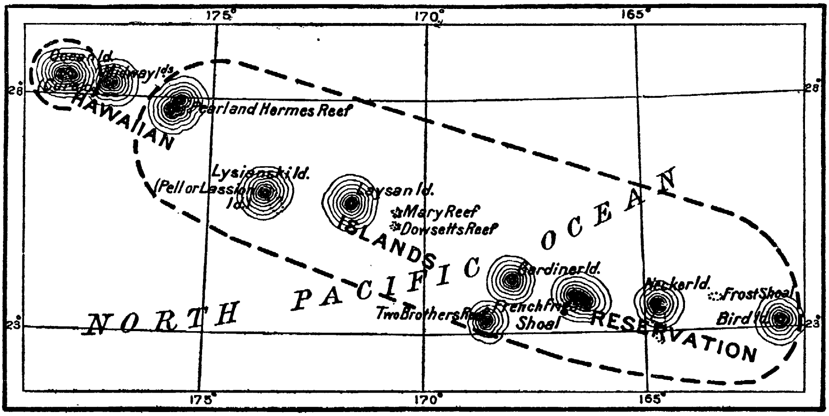

FIG. 1.—Hawaiian Islands Reservation for protection of native birds, Territory of Hawaii, embracing reefs and islets segregated by the broken lines and designated "Hawaiian Islands Reservation."

This refuge consists of a dozen or more islands, reefs, and shoals that stretch westward from the archipelago proper for a distance of upwards of 1,500 miles toward Japan. The average distance between them is something like 100 miles. Some of them, like Necker, Bird Island, and French Frigate Shoal, are masses of volcanic rock thrust up out of the ocean and so steep and rugged as generally to be inaccessible to anything without wings. Others are little more than diminutive sand spits, snatched from the grasp of ocean by the aid of coral animals. Still others are larger, and a few, like Laysan, being covered with sandy soil, are clothed with a more or less flourishing growth of shrubs, vines, and grasses.

BIRDS AS CARRIERS OF SEEDS.

The sources of the vegetation and the means by which the seeds of plants and shrubs were originally transported to these distant ocean-girt islands, thousands of miles from the nearest mainland, are a most inviting field of speculation. The winds are capable of conveying minute seeds to great distances, and favorable ocean currents also materially aid as plant distributors. Birds, however, are doubtless the most important of nature's seed carriers. Viscid and hooked seeds attach to their plumage, or seeds may be carried in smears of earth or mud on feathers, bill, or feet. Such seeds may be transported indefinite distances and, once in a thousand years or so, dropped on soil favorable to growth. The members of the most recent expedition to the island, the Nutting party in 1911, were especially requested to examine carefully all their specimens of Laysan birds for the presence of seeds, and actually found attached to the foot of a Laysan albatross a seed of a species of the bean-caper family, which is generally distributed in the South Sea islands. So far as known the plant does not grow on Laysan, and had this seed chanced to fall in a favorable spot the flora of the island might have been enriched by another species. A still more striking instance of a bird acting as a carrier of seeds was observed several years ago by Mr. Bryan on Marcus Island, where he found no fewer than 40 seeds of a tree of the madder family adhering to the feathers of a shearwater. These and other similar facts show how the flora of oceanic islands may be transported by birds from island to island or from continents to distant shores.

RABBITS AS A MENACE TO VEGETATION.

Unfortunately, rabbits were introduced into Laysan a few years ago, and now they threaten the very existence of the island vegetation. Thus Mr. Bryan reports that many plants abundant at the time of his former visit in 1903 had completely disappeared by 1910. Others, though still living, showed the marks of girdling by the hungry rodents, a sure indication of their impending fate. If found impracticable to exterminate these mischievous mammals, it is hoped so to reduce their numbers as to render them incapable of much harm. The destruction of the island vegetation would be unfortunate for the bird reservation for many reasons, especially as it would end most of the insect life upon which depends the existence of the land birds and greatly reduce the number of breeding sea birds, several species of which nest in bushes or on trees. The shrubbery is necessary also to protect young birds from the rays of the burning sun.

THE NUTTING EXPEDITION OF 1911.

When the Iowa State University requested the cooperation of the Department of Agriculture for the purpose of securing for its museum representative groups of Laysan birds, the opportunity was welcomed, since it enabled the department to obtain an authentic report on the present condition of the avian colonies on the island as a basis for protective measures. The expedition, composed of 5 persons, was organized, though not accompanied, by Prof. C. C. Nutting, and by him placed under the immediate charge of Prof. Homer R. Dill. Prof. William A. Bryan, of the Oahu College, Honolulu, accompanied the party as a representative of the Department of Agriculture, and his services were particularly valuable, as he was able to compare present conditions with those obtaining at the time of his former visit, 8 years before. The party landed on the island April 24, 1911, and remained until June 5. The present paper is largely the result of the observations made by this expedition.

HISTORY OF LAYSAN ISLAND.

Laysan is the most important island of the group on account of its size, the extent to which it is covered with vegetation, and the fact that it is the only island of the chain which is inhabited by land birds. Its known history is brief. It was named Moller Island in 1828 by Capt. Sanikowitch, after his ship, in ignorance, apparently, of the fact that it had been previously discovered by an American ship. In 1834 a brief account of the island and its birds was published in the Museum Senckenbergianum Abhandlungen by the well-known traveler and ornithologist F. H. von Kittlitz. He never visited the island, but obtained his data from the lips of Dr. C. Isenbeck, ship doctor of the *Moller*, who made a small collection of the island birds. In 1859 Capt. Brooks visited Laysan and in his interesting account reported, among other things, the presence on the island of 5 palm trees 15 feet high. These were probably the same species as the ones on Bird Island and also the one indigenous to the Hawaiian Islands proper (*Pritchardia gaudechaudii*). Schauinsland found only the stumps in 1896, and even these have since disappeared. Capt. Brooks collected 25 species of plants on the island. He also noted the presence on the shores of numbers of logs, drift from the northwest coast of America, more than 2,000 miles away. In 1891 Henry Palmer was sent to the island by Hon. Walter Rothschild and made a collection of its birds. Schauinsland's visit of three months followed in 1896, and his account, published in Ornithologische Monatsberichte in 1899 and in his Drei Monate auf einer Koralleninsel, contains many extremely interesting notes on the island birds. As Schauinsland records 26 species of plants it is evident that the flora of the island had not diminished in the 37 years following Brooks. The visits of Walter K. Fisher and W. A. Bryan followed in 1902 and 1903, and their valuable and interesting accounts bring the ornithological history of the island down to the date of the visit of the party in 1911 under the cooperative direction of the University of Iowa and the Department of Agriculture.

DESCRIPTION OF LAYSAN ISLAND.

Laysan is a raised coral atoll, doubtless on a volcanic base, about 2 miles long by 1½ broad, and in shape has been likened to a shallow platter (fig. 2). Its highest part is toward the north, where its

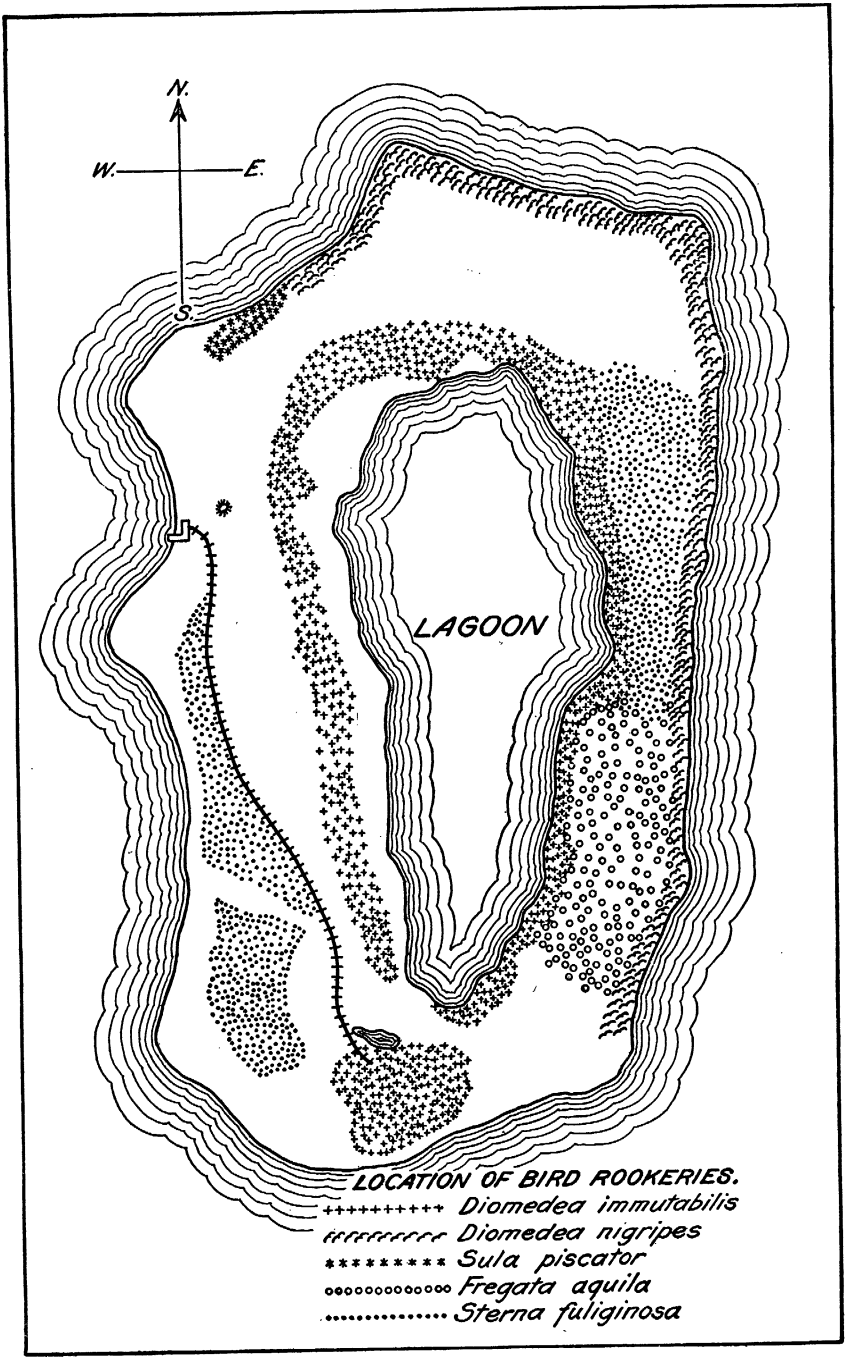

FIG. 2.—Bird rookeries of Laysan Island.

height does not exceed 30 feet above the sea. Its central lagoon, now unconnected with the ocean, covers about 100 acres. Not far from this lagoon is a pond of fresh or slightly brackish water, which is a favorite haunt of the Laysan teal and the bristle-thighed curlew.

THE LAND BIRDS OF LAYSAN ISLAND.

Though apparently not offering a very inviting permanent home for land birds, a number of these and one duck, waifs from more favored regions, have found their way here and become residents. The duck, though a distinct species, is closely akin to the Hawaiian teal, still more or less abundant in the archipelago proper. The little island colony, once numbering upwards of 100 individuals, is now nearly extinct, probably less than a dozen remaining.

Another of the land birds is a curious little rail, smaller even than our sora. None of the rail family are notable for wing power, but this particular species, and others in the South Seas more or less like it, is quite unable to fly. Where it originally came from is unknown. It may have reached its present abode by flying from island to island from Hawaii, where a related species is fairly common. As time went on, finding no particular need for its wings, it ceased to use them and became flightless. Whatever may be the ultimate fate of the Laysan colony of this remarkable so-called "wingless" rail, its future has been provided for in a measure by the export of a number to the Midway Island, far to the west, where it is reported to be flourishing, thus affording the only instance so far known of the successful introduction of a member of this family.

There is on Laysan a small red honey eater that lives chiefly on the nectar of flowers, as do its near relatives on the larger islands of the archipelago to the eastward; also a member of the warbler family of about the same size, originally probably from the Malay Archipelago. It is called the miller bird because of its partiality for millers or moths. Apparently this little warbler finds Laysan so much to its liking that it declines to extend its range to the Hawaiian Islands proper, which it might reach with very little effort. The list of land birds is completed by the Laysan finch, which is the chief musician of the island solitudes. During the long ages of its residence, unheard by human ear, it has trilled forth its beautiful song to the accompanying murmur of the trade winds and the rhythmic beat of the ocean surges on the desolate shore. Some years ago, when unprotected, these finches were trapped in numbers and sold in Honolulu for cage birds, but this traffic has now ceased. As suggested by Mr. Bryan, the above-named insectivorous land birds possess a high economic value and will well repay importation into the Hawaiian Islands proper, thus increasing there the number of insect-eating birds, as well as insuring the future existence of these unique and interesting species.

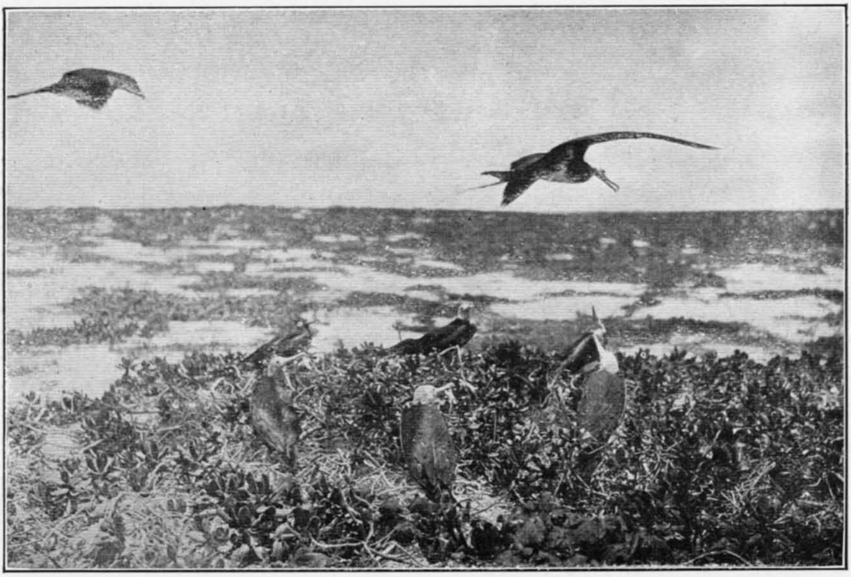

FIG. 1.—MAN-O'-WAR BIRDS NESTING, LAYSAN ISLAND.

FIG. 2.—COLONY OF GRAY-BACKED TERNS, LAYSAN ISLAND.

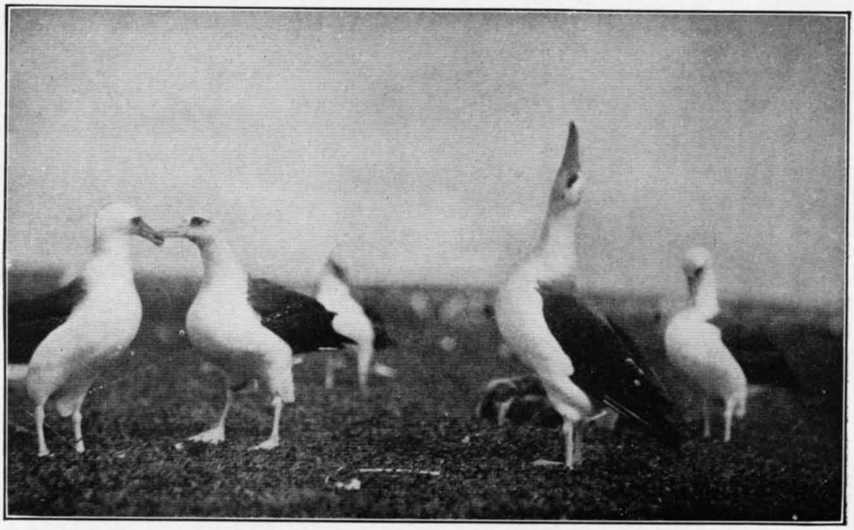

FIG. 1.—LAYSAN ALBATROSSES DANCING.

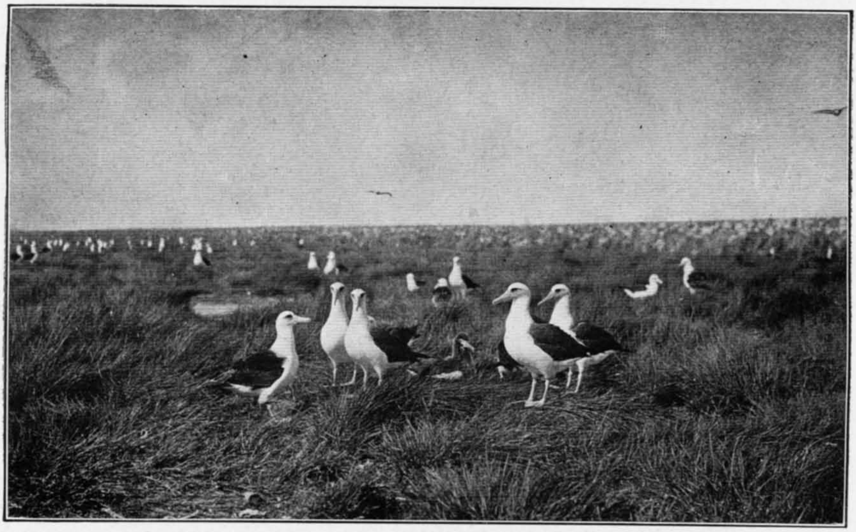

FIG. 2.—NESTING COLONY OF LAYSAN ALBATROSSES.

THE SEA BIRDS OF LAYSAN ISLAND.

But it is as a refuge for sea birds that these islands are chiefly notable. The reefs and waters about Laysan and the other islands fairly teem with fish, crustaceans, squids, and other forms of sea life, thus affording food in abundance for sea fowl, as well as solitude and protection for them and their young. For ages past these ocean wanderers have found the islands an ideal home, and at certain seasons swarmed there, covering every bit of available territory, and all in all forming perhaps the most remarkable bird rookery in the world. On Laysan alone several millions must breed every year.

NESTING.

Not all the birds that resort to this little island could possibly nest on it at one and the same time, and, as the result of ages of experience, each species comes in turn and thus secures room. Even so, however, nesting space has always been at a premium, and Schauinsland, who spent three months on the island in 1896, not inaptly compares the avian domestic arrangements there to a series of flats in a large town. Thus the petrels and shearwaters nest in underground burrows; above them in bushes nest the Laysan finch and the miller bird, while the uppermost accommodations are taken by the boobies and the man-o'-war birds. The breeding season covers practically every month in the year. After biding their time, hither come to nest thousands of terns, petrels, shearwaters, gannets, man-o'-war birds, and albatrosses. In all more than two dozen species of land and sea birds inhabit Laysan during the whole or part of the year. Prof. Dill estimated that at the time of the visit of his party upward of a million of sea birds were nesting on the island. (Pl. I.)

THE ALBATROSS.

Of all the birds that visit or live on Laysan the two species of albatrosses are the most notable. One of these, the black-footed albatross, lives chiefly in the north Pacific, but its range includes our own coast, from Alaska to California, and that of China and Japan. This is the species which is a familiar sight daily to voyagers from San Francisco to Honolulu. When the outward-bound vessel is well off the California coast it is sure to be sighted by a half dozen or more of these black-footed albatrosses (or goonies, as they are known to the sailors), which do not part company with it till near the Hawaiian Islands. The other species, known as the Laysan albatross, is chiefly a bird of the mid-Pacific, but it has been known to range to the eastward as far as the coast of Lower California.

Albatrosses are true ocean wanderers, returning once a year to some well-known island to rear their young. When they can trust these to care for themselves they put to sea, and the land knows them no more until nature again sounds the nuptial call. Their prodigious power of flight enables them to keep on wing for hours at a time and to circle around the swiftest steamer on outstretched wings without apparent effort. The ocean is lonely at best, but it would be still lonelier except for the presence of these splendid voyagers that follow the track of every outward-bound ship and serve to shorten both to landsman and sailor the tedium of the long voyage.

The two species that nest on Laysan formerly densely colonized all available space. They are the chief source of the valuable deposit of guano on this island. The island guano deposits were leased by the Kingdom of Hawaii in 1890 and were profitably worked for several years, when the deposits became exhausted. So valuable is guano as the basis of a commercial fertilizer that the Peruvian Government is making careful investigations on several of its own islands as to the rate of deposit and the best means of mining and conserving the supply. Several other of the Hawaiian bird islands have been exploited for guano, and there is no doubt that if the safety and perpetuity of the bird colonies on these island reservations can be assured, the guano deposits can be worked at stated periods indefinitely and made the source of considerable profit.

Albatrosses on their nesting grounds are exceedingly tame and have so little fear of man as to permit close approach when on their eggs or when caring for their young. Their unsuspicious nature thus peculiarly exposes them to danger from feather hunters, as they can readily be killed with clubs. These big sea birds indulge in a curious pastime, which is in the nature of a grotesque dance or "cakewalk." (Pl. II.) Both the island species indulge in this practice, which has been witnessed and described by a number of observers. Prof. Homer R. Dill in his report thus records it as performed by the Laysan albatross:

> The performance is varied, but usually begins as follows: One bird will approach another with an indescribable squeaking sound, bowing all the time. If the other bird feels like performing, which is usually the case, he bows in return. They cross bills very rapidly several times. Then one bird turns its head and lifts one wing in such a manner that the primaries point directly out at the side. In the meantime the other bird keeps up a loud noise that sounds somewhat like the neighing of a horse. The bird taking the lead then walks around his partner, stepping high, like a negro cakewalker. This part of the procedure is usually closed by one or both birds pointing their beaks straight up in the air, rising on their toes, puffing out their breasts, and uttering a long-drawn groan. The same thing is repeated many times with slight variations.

Just why the birds indulge in these curious antics it is difficult to conjecture, unless it is by way of amusement to pass away the time while on shore leave. Albatrosses are not at all exclusive, but are ever ready to acknowledge polite attentions from any and all sources, and when favored by a human being with a bow respond in kind with the utmost gravity and good will.

RAVAGES OF PLUME HUNTERS.

Eight years ago Mr. Bryan found much of Laysan literally covered with these splendid birds, but when visiting the island last year he discovered that more than half of the colony had been wiped out of existence by plume hunters. Prof. Dill estimates that only about one-sixth of the original colony of the species known as the Laysan albatross (*Diomedea immutabilis*) is left. The plume hunters landed on the island in May, 1909, and straightway began the work of slaughter. By the fall of the same year they had killed upward of 300,000 birds. While apparently albatrosses were the chief objects of pursuit, the feather hunters did not neglect other birds, and the list of slain includes, besides the Laysan and black-footed albatrosses, the sooty tern, gray-backed tern, noddy tern, Hawaiian tern, white tern, Bonin Island petrel, wedge-tailed shearwater, Christmas Island shearwater, red-tailed tropic bird, blue-faced booby, red-footed booby, man-o'-war bird, bristle-thighed curlew, and, without doubt, the island duck and such of the smaller birds as the hunters were able to secure. Bryan in his report to the department says, substantially:

> The slaughter wrought by the foreign plume hunters is everywhere apparent. One of the work buildings formerly used by the guano company and later as a storehouse by the poachers is still standing. Though with a side torn out and left open to the weather by the men of the *Thetis*, it is still filled with thousands of pairs of albatross wings. Though weather-beaten and useless, they show how they were cut from the birds, whose half-bleached skeletons lay in thousands of heaps scattered all over the island.

Plume hunters the world over are not noted for the virtues of forbearance and humanity, but these men seem to have adopted exceptionally cruel methods on Laysan. Thus Prof. Dill in his report states:

> An old cistern back of one of the buildings tells a story of cruelty that surpasses anything done by these heartless, sanguinary pirates, not excepting the practice of cutting the wings from living birds, leaving them to die of hemorrhage. In this dry cistern the living birds were kept by the hundreds to slowly starve to death. In this way the fatty tissue lying next to the skin was used up, leaving the skin quite free from grease, so that when they were prepared little or no cleaning was necessary.
>
> Many other revolting sights, such as the remains of young birds that had been left to starve and birds with broken legs and deformed beaks, were to be seen. Killing clubs, nets, and other implements used by these marauders were lying all about. Hundreds of boxes to be used in shipping the bird skins were packed in an old building. It was very evident that they intended to carry on their slaughter as long as the birds lasted.

In January, 1910, the nefarious work was stopped by the arrival of the United States revenue cutter *Thetis*, and 23 poachers were arrested and conveyed to Honolulu, together with the plumage which they had baled preparatory to shipping to Japan. The wings and plumage of approximately 259,000 birds were thus confiscated. As previously a party intent on the same errand had landed on Lysianski, another island of the same group, and spent months in killing sea birds and stripping off the plumage, it is probable that not far from a million of our sea birds were killed by aliens to sell to European milliners. The magnitude of the offense is better appreciated when it is understood that many sea birds, like albatrosses and others, lay only a single egg during the entire year, and as the natural mortality among both old and young is very considerable, years must elapse ere the greatly depleted colonies can be restored to their full strength. Dame Fashion has many sins to answer for, but few of greater magnitude than the wholesale slaughter of these stately creatures.

Had the raiders not been discovered, without doubt they would eventually have killed every nesting bird on this and the other accessible islands and converted these unique possessions of ours into veritable shambles. At the time of the visit of the party in the summer of 1911 heaps of the bodies of the slain still lay on the ground, mute witnesses of the sad fate that had overtaken these beautiful birds.

PROTECTION ESSENTIAL TO PRESERVATION OF RESERVATION AND SPECIES.

As the islands are part of our National possessions and have been set apart as a bird reserve, the care and the protection of their avian inhabitants would seem clearly to devolve upon the Federal Government. It is true that their remoteness and inaccessibility render it difficult to guard them properly. An effort, however, will be made to secure from Congress sufficient funds to provide for the services of a warden for Laysan and for an assistant. It is hoped also to secure a small power boat of adequate size to enable trips to be made between Laysan and the other islands and Honolulu. These measures, if supplemented by an occasional visit from one of the Government cutters during the height of the breeding season, will insure the continued safety of the nesting colonies. From a variety of causes sea birds are being reduced in numbers almost everywhere, chiefly as the result of plumage hunting and of the growing scarcity of breeding sites. Hence these island bird colonies, one of the wonders of the world, will become of increasing importance with each succeeding year. They should be regarded as a National heritage, and the birds be adequately protected, not only for the sake of our own citizens, but for those of other countries whose people go down to the sea in ships. Otherwise these birds will suffer the fate that overtook those on Marcus Island, also one of our possessions, where, as reported by Bryan, in six years a colony of albatrosses almost as large as that of Laysan was reduced to less than a score of birds through the unchecked activities of feather hunters.

THE REDUCTION OF WASTE IN MARKETING.

By Frank Andrews,
Assistant Chief of Division of Production and Distribution, Bureau of Statistics.

INTRODUCTION.

Of the items entering into the cost of marketing fresh fruits and vegetables, possibly one of the greatest is the loss due to waste. Two important causes of this waste are slowness of delivery to the buyer and the glutting of markets. Delay in transportation may cause the produce to decay or wilt, so that it may bring small, if any, returns, or, even if it arrives in good condition, it may be too late to be sold at good prices. A loss in selling price may be caused also by a faulty distribution of consignments, whereby some markets are overstocked, while there is a scarcity at others. These two causes of waste are being overcome, to some degree at least, by improved methods of distribution, as used by shippers, and by better transportation service.

It is the purpose of this article to show the working of two general plans, whose extended use dates back scarcely 10 or 15 years. One plan is used by shippers to distribute consignments among cities and towns in such manner as to avoid a glut; the other scheme is employed by transportation companies to move perishable freight quickly, and at the same time to be ready to change its destination on short notice, even when it is on the way to market.

THE CARLOAD AS A UNIT.

A SAVING IN MONEY AND TIME.

In farming on a large scale, the unit of quantity for a shipment is regularly a carload. The advantage of a car lot over a smaller quantity is so great that the smaller shipment competes at a disadvantage, except in near-by markets. Not only are the freight rates for carloads lower, but the time of transit is shorter and the risk of injuring the produce in transit is less. A car lot may be sent to any one of a large number of cities and towns, while the smaller shipment is limited, by the higher freight rates and by delays in transit, to fewer markets.

Since car-lot shipments form such a large proportion of the total supply, conditions which affect their marketing influence also the marketing of the smaller lots of highly perishable fruits and vegetables. Home-grown produce is more apt to bring good prices in the neighboring city or town under conditions which tend to reduce the danger of an oversupply from distant regions. Hence, changes affecting the movement of carloads, as discussed in this article, affect the entire truck-growing industry.

There are a number of plans by which small shippers join in making up a carload. This is regularly done by farmers' cooperative associations. Country buyers also gather produce from various farmers, arranging their purchases so as to have carloads for shipment. Of the other plans for combining smaller lots in carloads, two of the more noteworthy are the local "pick-up" service of some railroads and the system employed by some forwarding agents.

COMBINING SMALL LOTS.

There are forwarding agents whose business it is to collect small consignments at various points in the Mississippi Valley and to ship them to market. The forwarding agent gathers enough produce to make a full carload at a given station, consigns it to himself at the destination, and delivers the contents to various consignees. By this system a small shipment by a producer is carried as promptly as a full carload. The territory served by these forwarders includes stations in Louisiana, Mississippi, Tennessee, Illinois, Michigan, and a few points in Indiana. The forwarder, being responsible to the shippers, makes it his business to check the contents of the car as they are taken out, to note their condition, and to report to the shipper any irregularities as to the condition or number of packages. The car manifest of the forwarder shows the names of the shippers and of the consignees, the number and contents of packages. The manifests that happened to be in the office of one of these forwarders one day in July, 1911, and which were apparently not unusual, contained each a long list of separate items; the manifest for one car contained a list of packages for no less than 32 different consignees.

A so-called "pick-up" system is conducted by different railroads for collecting less-than-carload lots from various stations and combining them at transfer points into full carloads. Small consignments are collected from a number of stations and brought to a given point to be combined into carloads. Among the typical transfer points for combining small shipments into carloads are Canton, Miss., and Norfolk, Va.

The growth of freight and express service on interurban trolley lines has made it easier to market small shipments of perishable fruits and vegetables promptly. The interurban electric lines gather up small shipments and concentrate them at forwarding points. Large quantities of fruits and vegetables are thus handled from points in southwestern Michigan. The produce is collected from such points as Berrien Springs, Eau Claire, and Millburg, and transferred to boats at St. Joseph and Benton Harbor to be forwarded thence to Chicago. This service is prompt; fruit collected one day is on the Chicago market early next morning. A similar traffic is carried through Norfolk, where railroad freight from truck-growing regions is transferred to coastwise steamers for New York and the North.

FREIGHT SERVICE.

GENERAL IMPROVEMENTS IN RAILROAD FACILITIES.

Progress in methods of hauling perishable fruits and vegetables is part of a general betterment of railroad service. Improved roadway, heavier rails, larger cars, and more powerful engines, together with more efficient handling of the traffic, all help toward quicker and cheaper marketing of produce. Some of the features of these improvements are shown in statistics compiled by the Interstate Commerce Commission.

Within the past 20 years the quantity of freight moved has increased many fold. During the year ending June 30, 1889, the freight traffic on railroads of the United States equaled about 69,000,000,000 ton-miles; 20 years later this freight amounted to 219,000,000,000 ton-miles. This increased traffic is accounted for not only by an extension of railroads, but by an increase in the amount carried per mile. The density of the traffic in 1909 was more than double that in 1899. To move this freight the size of the trains was increased as well as the number of locomotives. In 1889 there was an average of 10 and in 1909 between 14 and 15 locomotives in the freight service for every 100 miles of railroad, while the average number of tons carried in a freight train more than doubled.

TRACING A CAR'S MOVEMENTS.

The freight carried on many railroads is divided into classes, based upon the kind of service rendered. The highest class of goods is given the quickest and most regular service. A second class of goods, and even a third or a fourth, may also be moved in trains having regular times for arrival and departure, but which are slower than the "manifest," "red ball," or "vegetable express" trains. These classes are distinct from the classes upon which freight rates are based.

Fresh fruits and vegetables are usually included in the list of commodities which are given this best service. Trains carrying these perishable products are run at greater rates of speed and with greater regularity than are ordinary freight trains. Delays are reduced to a minimum, and especial care is taken to have the cars carrying these fruits and vegetables move promptly along the way. Where the traffic justifies it, entire trains are made up of such produce.

One feature of this service is the telegraphic report which is made of each car as it passes each reporting station on its route. These "passing" reports, however, are made, on some railroads, for lower classes of freight also.

Some of the principal parts of this system were in use before 1885 on at least one railroad. Cars were reported by telegraph on passing certain points, and their movement was recorded in the central office, not only in writing but by means of pegs. Each car was represented by a peg bearing the symbol of the car and inserted in a block which represented the train. The route over which the cars moved was represented by a board on which vertical lines and spaces indicated the various stations from which "passing" reports were made. When a train was reported to have passed a station, the block representing the train was moved past the place on the board that represented the station. The telegraphic report mentioned each car in the train; cars not so mentioned were accounted for, with the reason for delay, or were the subject of prompt inquiry from the central office. This system is now in use on a number of railroads. The information shown on the board is kept also in written form, and, on some railroads, it is summarized in circulars, issued daily. The "board" is a convenient but not an essential part of this system. Some railroads do not use a board at all; they keep all their "passing" records on paper.

To facilitate telegraphing in some of these "passing-report" systems, each car may be given a symbol after the train is made up. The symbol consists of a letter or group of letters, which indicate the station of origin, and a number to designate the car. The car is known by this symbol until it reaches its destination and the contents are delivered.

RATES OF SPEED.

The average rate of speed over long distances for carloads of perishable freight depends largely upon the character of the roadbed and the number of transfers from one railroad to another. From Los Angeles to Chicago and from Jacksonville, Fla., to Chicago, the rate of speed averages about 13 miles an hour, including all stops. One train was scheduled to run from Los Angeles to Chicago in 173 hours and 25 minutes, the average rate being 13.1 miles per hour. A vegetable express run from Jacksonville to Chicago over three or four different railroads covers about 1,140 miles in 89½ hours, the average rate being 12.7 miles per hour. By another route the trip from Jacksonville to Chicago is reported to be made in as short a time as 84 hours. Over some routes which do not traverse mountains the average rate, including stops, is about 16 miles per hour for long distances. A certain train from New Orleans to Chicago covers 930 miles in 57 hours and 20 minutes, the average rate being 16.2 miles per hour; and on the Atlantic coast a train carrying Florida produce northward runs from Tampa, Fla., to Richmond, Va., in 54 hours and 15 minutes, making an average of 15.8 miles per hour. After a train is once made up and does not have to stop so often to receive new cars the rate of speed is naturally much higher. Between Memphis and Chicago the average rate of speed for a certain train is 18 miles per hour, while the rate from New Orleans to Memphis is 14 to 15 miles per hour. From Tampa to New York the rate for the distance south of Potomac Yard, Virginia, is about 16, while the distance between Potomac Yard and New York is covered at an average rate of more than 18 miles per hour.

At the rates of speed mentioned in the preceding paragraph, a train would run from 312 to 432 miles in 24 hours. The time taken to move cars from Potomac Yard, Virginia, just south of Washington, D. C., to New York, is about 12¾ hours; to Boston from Potomac Yard, 36½ to 40 hours; and to Montreal, 46¾ hours. These figures include the time required for icing and for transferring the cars from one road to another. From Miami, Fla., to New York the time is approximately 96 hours, and from Miami to Chicago about 108 hours. It is thus possible for fruit and vegetables grown in regions as far away as southern Florida to be delivered to consumers in Chicago or New York within five or six days from the time of gathering.

REGULARITY OF SERVICE.

While these fruit and vegetable trains, as any others, may be late sometimes, nevertheless their regularity is such that transactions are reported to be made often, if not usually, with the expectation that the produce involved will be delivered at about a certain time on a certain day. For instance, a car of vegetables from a South Atlantic shipping point may be bought by a dealer, who expects the car to reach Jersey City on a Friday night in time to be ferried across North River to a wholesale market in New York, which opens at 1 a. m. Should this car be delayed several hours the vegetables would miss the Saturday morning market and might be delayed two days in reaching the retail merchants.

Two instances of delays will serve as illustrations. A merchant in Philadelphia mentioned a consignment of strawberries which reached that city from Florida six days late, and a Chicago dealer complained, about the same time, of losing $500 on a car of strawberries that reached him too late to take advantage of a good market. Delays like these, it is believed, are by no means as frequent under present conditions of freight service as in earlier times.

EXTENSION OF DEMAND AND SUPPLY.

NUMBER OF MARKETS.

Inquiries were made by the Bureau of Statistics of this department in August, 1911, as to the different kinds of highly perishable fruits and vegetables which were received in car lots for local use in cities having a population of not less than 25,000. Of the 103 cities for which reports were made, peaches were sold by the carload in at least 87; watermelons, in 86; cantaloupes, 77; bananas, 72; strawberries, 71; tomatoes, 66; oranges, 65; grapes, 53; lemons, 39; pears, 32; pineapples, 28; plums, 24; celery, 18; cherries, 13; cucumbers, 11; green beans, 11; apricots, 11; and each of about 25 other commodities of this class were reported to have car-lot markets in from 1 to 10 different cities. The reports on which these figures are based are probably incomplete to a greater or less degree; some products are no doubt omitted which should have been included. If it had been possible to secure complete lists of all such products for each of these cities, the figures just given would probably have been larger. As they stand, these incomplete figures show a wide range of markets where car-lot shipments of fresh fruits and vegetables may be sold. The producer has many good outlets for his crops; if market conditions in one place are not satisfactory, there may be other places where fair prices may be obtained. The cities which absorb these products by the carload include many whose population is less than 50,000. Of the 87 car-lot markets for peaches for which returns were made in this investigation, 30 were cities of less than 50,000 inhabitants; 23 of these smaller cities took cantaloupes by the carload, 19 received grapes and strawberries, and 17 received tomatoes. Other products of this class also found sale in car lots among these smaller cities.

The number of car-lot markets for fruits and vegetables has increased greatly during the past decade. This is indicated by reports made by railroad freight agents and produce dealers in various cities as to the year in which the first carloads of certain products were received for local use. The products for which the fullest reports were made were peaches, strawberries, cantaloupes, tomatoes, and grapes. Of the 42 markets which reported the year when the first carload of peaches was received for local use, 13 had become car-lot markets within the past decade; the markets whose first carload sale of strawberries was made since 1900 numbered 15 out of a total of 35 reported; for cantaloupes, 21 out of 40; tomatoes, 19 out of 32; and for grapes the car-lot markets, which were opened within the past 10 years, numbered 13 out of a total of 24 for which reports were received. Taking account of the minor products of this trade, as well as the five leading ones just mentioned, the average rate of increase in the number of car-lot markets for highly perishable fruits and vegetables was over 40 per cent in the decade beginning with 1901 as compared with the ten years just before.

WIDE RANGE OF SOURCES OF SUPPLY.

Many of the large markets, and smaller ones also, receive their fresh fruits and vegetables from regions which are far apart. The examples given here refer to large cities, but illustrate conditions at many others. The sources of supply of a given product in a market like Chicago or New York may often be traced by the price quotations in those markets for perishable fruits and vegetables. It is common in those, and in other markets as well, to mention the State or locality where the products quoted were produced. By tabulating quotations of different commodities it is thus easy to learn also the time when the produce from a given locality is on a given market. For the season of 1910 the quotations of Florida tomatoes appeared in the produce reports at Chicago, New York, and Kansas City early in the winter and continued to about the middle of June, when Texas tomatoes began to appear. These were followed, in the Chicago market, by shipments from Mississippi, and about the first week of July by the produce of more northern fields. Among the States which contributed tomatoes to the Chicago trade in 1910, besides Florida, Mississippi, and Texas, were California, Tennessee, Missouri, and, of course, Illinois. New York's supply came also from a large number of States, among which were California, Florida, Texas, Mississippi, Tennessee, Virginia, North Carolina, South Carolina, New Jersey, Maryland, and Delaware, while some were imported from Cuba.

The supplies of peaches, strawberries, cantaloupes, string beans, and other products were also drawn from a wide range of territory. In 1910 there were at the same time quoted in New York City strawberries from Florida, Louisiana, Virginia, Maryland, and the Carolinas, and while some of these southern berries were still in the market, supplies came in from New Jersey and New York. The cantaloupes used in New York, in the latter part of June and the first of July, 1910, were coming from Florida, Georgia, and the Carolinas, and also from Arizona and the Imperial Valley of California. A few weeks later melons from Maryland, Delaware, Virginia, and New Jersey met, on the same market, those from New Mexico, Nevada, and Colorado.

In April and May of the same year the asparagus sold in New York City was grown, some near the Pacific coast and some in the regions along the Atlantic. Peaches from Texas and other western States were included with those from eastern States in the receipts at New York.

The sources of supply in a given market are governed to some degree by changing conditions of trade. Under some conditions it would be profitable for the produce of a certain State to compete in a given city with produce from States which are nearer that market, but whose own crops are short. For instance, when the Arkansas peach crop is small, Georgia may be shipping to points as far west as Denver, while if the Arkansas yield is large, Georgia peaches might get into few markets west of Chicago.

SYSTEMATIC DISTRIBUTION.

FINDING A MARKET.

A personal acquaintance between buyer and seller is an important factor in successful marketing. A truck gardener who visits the different markets occasionally and meets dealers there is in a much better position to sell his produce than if he consigned it to strangers; and, further, the cooperative association having representatives in important markets throughout the season may be expected to sell on much better terms than the individual shipper who visits the market only occasionally. Likewise, among merchants, the man who keeps in touch with other markets knows much better how to distribute his excess supply, or send orders to meet the demands of his customers, than the dealer whose acquaintance is not so large.

The shipper or his representative should know also the characteristics of the various markets which may take his produce. For instance, a certain town will be able to use one full carload of cherries, while for another town it would be better to make up a mixed car consisting of cherries and two or three other kinds of fruit; or, again, in one city, as New York, it is important for certain produce to be delivered in time for the night market, while at Chicago the shipments will be on time for the regular market if they reach the railroad terminals or the steamboat wharves before daybreak.

Reports of market conditions are given regularly and with varying degrees of accuracy in daily newspapers, trade and agricultural journals, and in circulars issued by dealers and organizations. In addition to these sources of information, some shippers and dealers receive special reports, by mail or wire, from different markets.

CONTROL OF PRODUCE IN TRANSIT.

Information as to the location of a given car in transit may usually be obtained from the railroad company which is hauling the car. But some large shippers have a system of their own by which they trace the movement of cars in transit, in order to distribute them among the different markets to the best advantage. One organization in California adopted this system of distributing shipments: When a member shipped a car of produce, he turned the bill of lading over to the manager of the organization and allowed him to direct the movement of the car to market. The object of having one central authority select the markets was to prevent sending an oversupply to any one place. On receiving the bill of lading, a record of the car was made on a card in the office of the organization and the card filed in its proper place in a drawer. This drawer was divided into several rows of compartments, opening upward; each row had 31 compartments, and there was one row for each principal market in the United States. The 31 compartments represented each one day of a month. When a card was filed its location was determined by the destination named in the bill of lading and by the day of the month on which the consignment was due at the destination. For instance, a carload of cherries shipped to New York from a point in the Sacramento Valley on May 27 would be represented by a card filed in the New York row of the drawer and in the compartment numbered 7, if the consignment would be due in New York on June 7. The arrangement of these cards showed at a glance the intended distribution of this association's shipments among the different markets, and when too many consignments of a given kind of fruit were on the way to a given market the grouping together of several cards in one box served as a warning that the destination of one or more cars should be changed. This drawer showed only such fruit as was shipped by this association. News of other shipments and of their probable time of arrival at destination was secured, to some extent, by the association. When it became known that a certain market was about to receive an oversupply of a given fruit, one or more of the shippers who had consigned to that market would be notified by the association manager, so that they might select another city to which to divert their consignments. In case they should refuse to make such a selection the rules of the association gave the manager the right to divert the shipments himself.

The movement of a car in transit was traced by the association by a system similar to that used by some railroads. Each car shipped east by the association was reported by telegraph as it passed certain points along the way.

In a similar way other large shippers keep in close touch with the progress of a car on its way to market, at the same time keeping informed as to the prices and relative supplies in different cities and towns.

For produce moving from the South northward many of the principal points of diversion are along the Ohio and Potomac Rivers, but the route of a car may be changed at any one of a large number of railroad-junction points. Cairo, Louisville, Cincinnati, and Potomac Yard (near Washington) are important points from which these shipments are distributed among various destinations.

Between eastern markets and producing regions in the far West and Southwest the chief points of diversion include Minnesota Transfer (between St. Paul and Minneapolis), Council Bluffs, Chicago, and St. Louis. Over one route from central California to the East the principal points from which one leading shippers' association receives "passing" reports are Roseville and Truckee in California, Ogden, Council Bluffs, and Chicago. A Cincinnati firm may receive notice of a Florida shipment when the car passes Jacksonville, Atlanta, and Chattanooga, and another notice just before the arrival at Cincinnati. On peaches shipped by this fast-freight service to northeastern markets from Tampa, a car's progress over a certain route is reported from Jacksonville, Fla.; Savannah, Ga.; Columbia, S. C.; Hamlet and Raleigh, N. C.; Richmond and Potomac Yard, Va.

The service of diversion includes not only changing the destination of a car in transit but forwarding it to a destination beyond the one originally named. For instance, a car shipped to Cincinnati may be forwarded under certain conditions to Indianapolis for unloading; or, it is reported, a car consigned to a given town may be partly unloaded there and the remainder of the consignment sent on to another town. This, however, costs more in freight than would a direct shipment of a full carload to one market.

HOW A CAR IS DIVERTED.

Conditions on one route will illustrate how the system of reporting car movements may be used by a patron of the railroad. Suppose a dealer in Chicago, on a Thursday morning, wishes to know the location of a carload of tomatoes which were shipped to him the morning before from Crystal Springs, Miss. He makes the request of the railroad company's agent in Chicago, giving the initial and number of the car and the date and place of shipment. On consulting the "passing" reports it is found that this car, known in transit by the symbol "CS-4," passed Fulton, Ky., at 6 a. m. that day (Thursday) and would be due at Cairo, Ill., at 8.30 a. m., or, let it be assumed, about an hour after the time the dealer made inquiry. It would be due in Chicago Friday at 4.50 a. m. With this information the dealer knows that, if he desires to divert the car, he may select one of a number of markets located north of the Ohio River. He knows that there is a large movement of tomatoes toward Chicago and believes that the prices on Friday will be better in some other places than in Chicago on the day his produce is due on the market. He has already received news from some points. An associate in St. Louis may have telegraphed the evening before that the supply already in that market, together with what was due to arrive on Thursday, would be about as much as could be sold at fair prices; that, if more was received, prices would probably be low. On the other hand, a report from Indianapolis may indicate good prices for Friday morning, better ones than are promised in Chicago for that day; so the Chicago dealer orders the car to be diverted to Indianapolis. He may wait until 3 p. m. Thursday before reaching this decision, so that he may hear from other markets. Meanwhile the car has been moving northward. The order for diversion is sent by the superintendent of transportation to the proper official at Effingham, Ill., where the car is due to arrive about 5.45 p. m., and where transfers are regularly made for Indianapolis. It reaches that city early Friday morning, about the time it would have reached Chicago had there been no diversion.

DISTRIBUTING A CAR LOT.

Cities and towns which do not require a full carload of a given product are often supplied from neighboring car-lot markets. Small lots of perishable goods may be forwarded in refrigerator cars devoted to local service. For small consignments of fruit and vegetables intended for neighboring towns refrigerator cars are run on regular schedules from Chicago and other large cities, and each car is assigned its own route. The service on one railroad will illustrate this traffic. This railroad sends out from Chicago, every night except Sunday night, 11 trains hauling such cars. One of these trains, leaving Chicago at 9.45 p. m., takes cars for 14 different routes; three of these cars are run only two days of each week, five of the cars are run on three days of the week, and six cars are run on six days. A car may be transferred from one train to another, making one, two, or more transfers before it reaches its destination. From this train cars are transferred at various points in Iowa; one car is taken off at Cedar Rapids, another at Marshalltown, still another at Ames, a fourth at Tama, while at Eagle Grove three cars are taken off and given to three different trains. At Belle Plaine two more trains are each given a car, and at Mason City another transfer of a car is made.

Interurban electric lines and steamboats help to distribute small lots of fresh fruit and vegetables from car-lot markets. In addition to the traffic on steam railroads, large quantities of this kind of produce are thus distributed from Cincinnati by trolley lines and river boats, while lake steamers assist in this work at Chicago.

Shipments of less-than-carload lots of this highly perishable produce are apt to be more frequent in times of high prices. Under some conditions less-than-carload lots may be shipped all the way from Chicago to St. Paul, or even to Omaha. But, as has been said in the first part of this article, the regular way of transporting these fresh fruits and vegetables is by carload lots, shipments in smaller quantities, except for short distances, being made chiefly to markets where a larger quantity could not be sold.

CONCLUSION.

The extension of better ways of distributing fresh fruits and vegetables among the various markets and the improvement in transportation service have done much to reduce the waste in marketing, but there is still room for improvement. Sometimes a crop in a given region will be too large to be marketed promptly. There may be too few cars to carry the produce, and it spoils while awaiting shipment; or it may be loaded in cars and started on its way, but the increased number of cars may be more than the railroad can handle promptly, and a congestion of traffic may cause a delay of several days on the way. Or, even with quick and adequate freight service, the produce may yet fail to be well marketed. It is not always practicable for shippers to determine beforehand the approximate supply which a given city or town is about to receive, or to judge how much can be sold there at fair prices, and an error in the shippers' judgment may result in glutting a market.

But in spite of occasional losses due to car shortages, freight blockades, and overstocked markets it is a widespread opinion among shippers that there are fewer losses on fresh fruits and vegetables now than there were 10 or 15 years ago; and the tendency of the present time is to reduce still further the waste in marketing.

PRIMARY PRINCIPLES IN THE PREVENTION AND TREATMENT OF DISEASE IN POULTRY.

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CLEANLINESS THE ONE FOUNDATION.

It is the object of this paper to impress upon poulterers the one basal principle underlying all rules of health and upon which only can be erected a successful system of treatment of disease in poultry. In the final analysis one word furnishes the thesis of this paper and sums up its conclusions. That word is "cleanliness." The writer is fully convinced that cleanliness is at once the corner stone of health and the keystone of the arch of healing. His desire is that the perusal of this paper shall compel all readers into such acceptance of this conviction that hereafter they will make cleanliness the foundation of whatever measures they may adopt for the promotion of health and the prevention of disease, and the groundwork for all methods selected by them for the treatment of disease and recovery of health. If it can be shown that all deviations from health involve the integrity of this fundamental principle, cleanliness, it necessarily follows that any attempt at recovery must seek to restore cleanliness. As cleanliness is the first law in the science of preserving health, so is it the primary principle in the healing art.

This fundamental doctrine of cleanliness as applied in this paper to the well-being of poultry may be expressed in three general principles: (1) Clean intake; (2) clean output; (3) clean surroundings. The intake includes food, drink, and air. The output consists of excrementitious matter from the alimentary tract, the excretion from the kidneys, and the products of the reproductive system. The surroundings comprise houses, grounds, and air.

DEFINITION OF CLEANLINESS.

What does the word "cleanliness" mean to us? If we study the dictionary, we shall find that cleanliness means freedom from dirt or foreign matter. Our conception of cleanliness must therefore depend upon our notion of dirt, and that notion is largely a matter of training, habits, and associations.

The philosopher has defined dirt as "matter out of place." Matter that is all right and clean in one place may be all wrong and dirt in another. Moreover, cleanliness is one thing to the ordinary person, but altogether another matter to the hygienist. The eye with the microscope has a larger apprehension of dirt than the unaided eye.

The good housekeeper sees with annoyance the specks of dust and is satisfied with their removal; the intelligent surgeon whose vision has been enlarged by the microscope sees the millions of bacteria that use a single speck of dust as an airship, and he knows of the possibility that tetanus bacilli or other germs may fall, unseen, from such dust on to the raw surface of an exposed cut upon a person's skin. He therefore can not call the cut surface of the wound "clean" until he has thoroughly washed it and applied a disinfectant in order to kill those germs. The apples on the street vender's stand glow with apparent cleanliness, but those same apples may have been polished with a soiled pocket handkerchief, and the bacteriologist might well tremble at the thought of the tubercle bacilli that may be on those skins. The cook washes the lettuce leaves to remove the bits of adherent dirt, and the salad made therefrom may look and taste all right; but the unaided eye can not see the typhoid germs or other intestinal microbes derived from the sewage with which that portion of the garden stuff was fertilized.

The conception of dirt and cleanliness in this paper is formed by the sanitarian's training, habits, and associations. However, the writer rejoices in the fact that nowadays farmers and poulterers are a class who read, and therefore have become somewhat familiar with the horizon of the scientist, so as to appreciate, in air and soil, in food and drink, in houses and incubators, upon the external and internal coverings of the chicken's body, the presence of innumerable microbes, many of them capable of producing decomposition and putrefaction, and thus likely to cause sickness through absorption of their poisonous products; many of them characterized as specific agents of disease, and therefore recognized as a definite menace to life; and large numbers of them viewed generally as harmless which yet by excessive multiplication induce conditions which become themselves sources of disease.

The presence of these microbes in localities where they do not belong, or in excessive numbers even where they do belong, medically speaking, constitutes dirt and calls for cleansing. To sum up, cleanliness involves not alone absence of dirt and foreign matter which can be detected by the unaided eye and removed by means of shovel and wheelbarrow, broom and dustpan; it involves also greater or less freedom from those myriad microscopic forms the removal of which is accomplished by disinfecting agents which destroy them.

SEVEN PRIMARY PRINCIPLES.

In the working out of this fundamental law of cleanliness seven rules or maxims have been formulated by the writer as furnishing, in a general way, the application of this principle to meet all the requirements of a successful poultry industry. These rules are but further divisions of the three general principles previously mentioned, and may therefore be regarded as the seven primary principles in the prevention and treatment of disease in poultry. They are as follows, and are expressed in mandatory form, since nature, in her sovereignty over animal life, demands cleanliness under penalty of disease and death: (1) Clean out; (2) clean up; (3) clean the water supply; (4) clean the food; (5) clean the eggs; (6) clean the incubators and brooders; (7) clean the breeding.

The ease with which these maxims can be carried out, and the cheapness of the articles employed for that purpose, combine to give them the maximum of practical value. It is true there are many different medicines with which to "clean out" the intestinal tract; there are a legion of disinfectants with which to "clean up" the soil, and numerous drugs with which to clean the water supply. If, however, the poultryman can become expert in the use of just one good and sufficient substance for the accomplishment of each of these primary principles, he is far better off than if his mind were stored with a whole materia medica which he has rarely or never tried. Notice how simply these maxims can be carried out.

Clean out by giving Epsom salt.

Clean up by spreading powdered air-slaked lime.

Clean the water supply by adding permanganate of potash.

Clean the food by preventing contamination or by heating.

Clean the eggs by dipping in grain alcohol.

Clean the incubators and brooders by scrubbing with hot water and good, old-fashioned kitchen soap.

Clean the breeding by using the youngest females consistent with the requirements of good breeding.

METHOD OF APPLICATION.

1. Clean out.—This is carried out as a routine hygienic measure by administering Epsom salt to the whole flock once a month from October to March, and twice a month from April to September. For this purpose the salt is best given in an evening mash, which, after the salt has been thoroughly mixed with it, should be sufficiently moistened with water to dissolve the salt. Let the mash be carefully proportioned to the appetites of the birds and fed on a dry, hard, clean floor, so that the whole may be eaten quickly. Epsom salt should not be wasted by putting it in the drinking water; the birds can not in that way take enough to secure the desired results.

The dose of Epsom salt may be estimated at one-third of a teaspoonful to an adult bird. Extra large fowls might receive a half teaspoonful, smaller or younger birds less. The writer usually prescribes one teaspoonful for three fowls, or for six to eight half-grown chickens, or for twelve to twenty chicks, according to age, size, and previous thriftiness.

Immediately upon the appearance of disease in the flock, without waiting to determine whether the sickness is infectious or not, all birds, sick and well alike, should receive a dose of Epsom salt by the method above outlined. If the disease proves to be infectious, flock treatment with Epsom salt should be maintained once a week during the prevalence of the epizootic. All sick birds, which should be isolated at once from the well, may be given Epsom salt from one to three times weekly, according to the nature of the disease and the severity of the symptoms.

The best method of administering Epsom salt (as well as other fluid medicines), although practicable where only a few birds require treatment, is by means of a small funnel and a piece of rubber tubing (three-sixteenths inch internal diameter). The funnel is inserted into one end of the tubing, while the other end, lubricated with lard or vaseline, is passed into the mouth, back over the opening of the windpipe at the base of the tongue, and down through the gullet into the crop. One or two ounces of water in which has been dissolved one-third teaspoonful of Epsom salt can now be poured into the funnel and the tubing gently withdrawn. Since Epsom salt acts best when well diluted, this method may be considered ideal. If slender tubing is used and one is ordinarily careful in passing the tubing over the opening of the windpipe there is absolutely no danger attached to this method. Moreover, there is the satisfaction of knowing that the entire dose has been received by the bird.

2. Clean up.—Do this by spreading powdered air-slaked lime over runs (and range, if possible), floors of houses, and on the droppings boards. Emphasis must be laid on the two qualifications here given to the lime; it must be powdered and it must be air-slaked. Lime that is not powdered, even if the lumps be very small, must be regarded with suspicion as not being slaked and therefore more or less irritant. As soon as the birds begin to scratch where the lime has been spread, thus raising a dust, the irritating particles of the unslaked lime are inhaled, and, reaching the lungs, set up inflammation. In this way one might have an outbreak of pneumonia in his flock and be unable to explain its origin.

3. Clean the water supply.—There are three methods of accomplishing this, each being so easy of application that it may be substituted with entire satisfaction for either of the other two. The writer's usual prescription is to add to the drinking water permanganate of potash in sufficient amount to give the water a claret-red color. For ordinary waters, comparatively free from organic material, the amount of the permanganate of potash necessary should be as much as can be dipped up on a silver 10-cent piece for each gallon of water. If more than four times this amount of potash is required to color the water, it is well to assume that the water contains too

much organic matter to admit of satisfactory disinfection by permanganate of potash.

In such a case the poulterer may employ the second method, that of adding sulphate of iron, commonly known as copperas. To 1 gallon of drinking water add 15 grains of copperas, which is approximately the amount that can be dipped up on a 5-cent piece. This proportion may be regarded as mildly antiseptic, but is as strong as should be used for any long period in view of its astringent action and drying effects on the lining of the digestive tract.

The third drug which the writer has found equally effective in the cleansing of drinking water is pure carbolic acid, in the proportion of one teaspoonful of carbolic acid to 1 gallon of water. The carbolic acid here recommended is of full strength. The poulterer who keeps on hand the acid in crystals may prepare the drinking water in the following manner: Place the unstoppered container in a pan of water; heat gradually until the crystals are melted. One teaspoonful of the melted crystals may then be added to a gallon of drinking water. If one desires to keep on hand a stock solution of the strong carbolic acid, he can purchase any desired amount of liquefied phenol (phenol is the official name of carbolic acid). Or the liquefied phenol can be prepared by the poultryman himself by melting the crystals of carbolic acid as described above and to every 9 parts by weight of the carbolic acid adding 1 part by weight of water. For use add 1 teaspoonful of liquefied phenol to 1 gallon of drinking water.

4. Clean feed.—Purchase clean feed at the outset, and preserve it in a clean, dry place protected from birds or other animals that might contaminate it with infective droppings. If through accident, such as dampness, mold has crept in, and it is necessary because of insurmountable circumstances to feed this material, apply strong heat.

5. Clean eggs.—Dip all eggs, just prior to incubation, in grain alcohol. This is, without doubt, the simplest and quickest method of disinfecting the shells of eggs intended for incubation. The writer has tried various dilutions, from 70 per cent alcohol to the 95 per cent usually sold in the shops, and has come to regard them all equally effective.

Another method of egg-shell disinfection, simple but not as quick as the alcohol method, is to wipe all eggs just prior to placing them in the egg tray with a cloth saturated with a 3 per cent solution of compound solution of cresol (liquor cresolis compositus) or cresol soap. (A 3 per cent solution of cresol soap is made by adding 2 tablespoonfuls (1 ounce) of compound solution of cresol to 1 quart of previously boiled water.)

6. Clean incubators and brooders.—This is carried out by thorough scrubbing with boiling water and old-fashioned kitchen soap. If, however, this should not be considered sufficient, there may be

applied, after the scrubbing, a spray with a 3 per cent solution of cresol soap, made as directed above, except that the water used in making the dilution need not be boiled, as suggested for egg disinfection.

Another excellent method of disinfection is by means of formaldehyde gas. The most widely accepted method of employing this disinfectant is that known as the permanganate-formaldehyde method. This consists of setting free the formaldehyde gas of the commercial product formalin (40 per cent formaldehyde in water) by the action of permanganate of potash. A modification of this method, known as the permanganate-diluted formalin, is particularly satisfactory because the addition of the water insures the moisture conditions needed for the best results from the formaldehyde, these conditions permitting also a marked reduction in the required amount of formaldehyde.

As a preliminary to all directions for this method of disinfection it should be stated that the best authorities do not consider formaldehyde efficient at a temperature lower than 60° F. nor with a humidity less than 65 per cent.

Where one has an incubator room, the room should be disinfected with the incubators and brooders in it, together with all other movable appliances of the poultry farm, such as feed and drinking utensils, trap nests, and other appliances. All detachable parts of these appliances should be removed and placed about the room in such positions that the gas may have easy access to all surfaces. Incubators and brooders should be thrown wide open. Now, plug up all openings, doors, windows, and cracks with bits of cloth or rags. Cracks and other openings offering perfectly flat surfaces may be satisfactorily sealed with strips of adhesive plaster or wet strips of newspaper. For a room containing 1,000 cubic feet (say 10 feet square and 10 feet high, or 10 feet by 12 feet and 8⅓ feet high) there must be used 11 ounces of permanganate of potash, 11 fluid ounces of formalin, and 9 fluid ounces of water. The procedure is as follows:

In the center of the room, upon the dirt floor or upon a base sufficiently large to protect the floor from stains by the red permanganate which may be spattered around, place a basin or flat earthen vessel with flaring sides that will not hinder the exit of the gas generated. In the bottom of this container place 11 ounces of permanganate of potash for every 1,000 cubic feet of space in the room. Have at hand 11 fluid ounces of formalin and 9 fluid ounces of water for every 1,000 cubic feet. Mix the formalin and water in a pail and pour the entire amount on the permanganate of potash. Leave the room immediately, closing the door tightly, and allow it to remain closed for from four to eight hours. After this the doors and windows should be opened (if possible from the outside in order to avoid entering the room and inhaling the pungent, irritating fumes of formaldehyde gas) and the room well aired for several hours.

It may sometimes become necessary to disinfect a single incubator or brooder. The following suggestions are offered for those who desire to use at such times the permanganate-diluted formalin method. Keeping in mind the impossibility of making these machines absolutely air tight, the writer is accustomed to recommend the following procedure and adaptation of the ratio mentioned above in the disinfection of an ordinary 240-egg incubator. Start the lamp, so that the incubator shall be thoroughly warmed. Cover the slat bottom of the incubator with a few layers of newspaper, tacking or pasting (preferably the latter) the four sides. Plug all cracks and openings except the door space. Whenever possible, soiled diaphragms should be replaced with new felt or burlap, as the case may be. If it is not feasible to do this, wash off all dirt and tilt the diaphragms inside the incubator so that they may not interfere with the free progress of the gas. Put out the lamp. Place in the center of the newspaper-covered floor of the incubator a saucer containing 1 leveled teaspoonful of crystals of permanganate of potash. Mix 2 teaspoonfuls of formalin (38 to 40 per cent formaldehyde) with 2 teaspoonfuls of water and pour upon the permanganate of potash. Quickly close the incubator door, making the cracks as tight as possible by means of wet newspaper. After four or five hours open and air the incubator for a few hours. The pungent, irritating, formaldehyde-laden atmosphere that sometimes lurks about the incubator after this treatment may be neutralized by placing in the incubator a saucer containing a very small quantity of weak ammonia water.

7. Clean breeding.—This is accomplished by breeding from the youngest females consistent with good breeding.

REASONS FOR APPLYING THE MAXIMS.

Let us look at some reasons connected with the application of each of the maxims.

1. Clean out with Epsom salt.—For the same reason that a chicken uses the dust bath, it is given the Epsom salt, namely, to get rid of or to diminish the number of parasites. The dust bath assists in removing the ectoparasites (outside parasites); the Epsom salt cleans out the endoparasites (inside parasites). Some of these may be large enough to be seen with the unaided eye, as, for instance, the various intestinal worms, whereas others may be minute enough to require high powers of the microscope for detection, or even be so infinitesimal as to belong to the class of ultramicroscopic germs.

It is customary to regard the presence of intestinal worms as a more or less normal condition and not deserving of any anxiety. But it may well be pointed out that the intestinal parasites of chickens, be they worms, molds, bacteria, or protozoa, are certainly not beneficial to the chicken. On the other hand, any one of them, no matter how apparently harmless, may produce disease or develop conditions in which certain well-known disease-producing parasites may operate, or may, during their so-called harmless development, evolve poisons which, given certain accidents to the lining membrane of the intestinal tract, may suddenly provoke a fatal disease in the bird. Hence it is necessary not only to clean out the intestinal tract by means of Epsom salt but to keep it in this condition.

What has just been said is not merely with reference to the prevention of disease. Suppose disease of any form has attacked the bird. It now requires the maximum of its disease-resisting powers for a successful defense. But suppose the bird is already engaged in battling with intestinal parasites and neutralizing their toxins. It is as if a nation engaged in civil war is suddenly called upon to defend itself against a foreign invasion. So, when the flock is attacked by disease or a single bird becomes ill, even though the affection be only bumblefoot, the poultryman should clean out with Epsom salt. By this means he will not only stimulate the disease-resisting forces of his birds, but will also relatively increase those powers by the removal from the intestinal tract of parasites and poisons which would otherwise have to be overcome.

2. Clean up by spreading powdered air-slaked lime.—This is important chiefly because of its association with No. 4 (clean food). More cases of disease are probably developed through parasite-contaminated food and drink than any other means. We have every reason to believe that the causative organisms of disease in the respiratory and digestive tracts are passed out of the body of the bird in immense numbers in the droppings. Thus disease is spread from bird to bird by means of the infective droppings of a sick fowl or chick; or it may reach the flock from a neighbor's sick poultry by the wind wafting the dust from his poultry yard contaminated with the infection-laden droppings of his diseased stock, or being tracked from his place by dogs or cats or even by mutual friends, or it may be carried from place to place by such birds as sparrows and crows. It must be remembered, too, that it is not alone the sick birds that are thus a source of danger. In poultry hygiene as in human sanitation one must beware of the "carrier" of causative agents of disease, not only bacillus carrier but microbe carrier, using this latter term to include the molds and microscopic animal forms, such as coccidia, the cause of white diarrhea in chicks, and also parasite carrier, under which term are included the larger parasites, such as worms. These carriers are divided into three classes—sick carriers, chronic carriers, and healthy carriers. Against the sick carriers the poultryman is naturally forewarned and forearmed. But as the soldier dreads the ambushed foe, so let the poultryman be wary of the covert attack on his flock by parasitic enemies which stealthily approach the bird

under cover of the "once sick but now supposed to be cured" bird (chronic carrier), and hidden in the intestinal tract of healthy birds (healthy carriers) that have simply picked up the parasites and are carrying them without being affected by them. Against all such risks the poultryman materially defends himself and his flock when he cleans up with powdered air-slaked lime.

Maxims 1,2, and 3 form together a strong combination in combating the baneful influences of these carriers. The sprinkling of the lime should be carried out the same evening that the Epsom salt is given. The cleaning-out process is accomplished largely during the night and the air-slaked lime on the droppings boards serves to destroy the parasites thus ejected from their harboring hosts, whether sick, chronic, or healthy carriers. Therefore, whenever Epsom salt is administered it is well to sprinkle air-slaked lime about the premises, especially under the perches.

3. Clean the water supply.—Water-borne diseases are frequent in the poultry yard. If the poultryman permits, consciously or unwittingly, to run at large one bird sick with any of the contagious diseases of the head parts or with bowel diseases, it is practically certain that the water supply will be contaminated in less than one hour's time. In the case of a large flock affected with flagellate diarrhea, the writer found the flagellates in less than one hour's time in the drinking water which had been sterilized and placed in thoroughly disinfected fountains. It is well known how boards of health throughout the country recognize the danger which lurks in the public drinking fountain, and endeavor to safeguard the public health by adopting the individual drinking cup. While the poulterer can not adopt the individual cup for his fowls, he can by hygienic methods secure an equally good result by adding every few days (daily during the prevalence of disease) one of the antiseptics previously mentioned on page 181. In the proportions named, these remedies do not actually disinfect the water, that is, destroy the microbes deposited in it by sick birds. They act rather as antiseptics; that is to say, they serve to inhibit the development of bacterial and other microbial life. This hindering of microbic growth occurs not only in the drinking fountain, but is maintained in the intestinal tract, thus making maxim 3 a splendid adjunct to maxim 2.

In ordinary circumstances, where drinking water is supplied in containers, these vessels should be sterilized once daily by means of hot water, and the water should be changed once a day in cool weather and twice daily in warm weather. During the prevalence of disease the water can not be changed too often and the vessels might well be scalded twice daily.

4. Clean food.—This, as before stated, must be accomplished by preventing contamination, or, when that occurs, by the application of

heat. A man once said to the writer, "Oh, chickens love moldy bread; they will eat all they can get of it, and it never hurts them." That man, unfortunately, had never learned to reason from cause to effect, and was, therefore, unfitted to deal with health questions. Few, if any, of the intelligent men and women who are practical poulterers would care to furnish moldy feed to their high-priced prize winners. Pathologists recognize a disease called mycotic enteritis, which is an inflammation of the intestinal tract, manifesting itself by diarrhea and caused by the presence of some mold. They also recognize mycotic pneumonia, which is an invasion of the bronchial tubes by the mold known as *Aspergillus fumigatus*, giving rise to the disease known as aspergillosis. This disease is of frequent occurrence in pigeons and pigeon feeders, owing to the presence of this mold on the corn which the feeders take into their mouths along with water and force into the mouths of the "squealers" in a fashion similar to that practiced by the parent birds.

It is hard to estimate the immense value that hopper feeding has been to poultrymen in that it preserves the food from contamination such as occurs when grain is scattered. Nevertheless grain must be scattered, for the scratching shed is a necessity. However, moldy litter should be avoided. The removal of moldy clover chaff has been reported as ending a siege of aspergillosis in chicks (brooder pneumonia). Recently one of the State experiment stations purchased for litter some straw that had been baled while damp. A few days after the introduction of this straw the chickens began to die. Post-mortem examination revealed pneumonia, the lungs showing minute white spots. Bacteriologic investigation of these spots demonstrated the presence of a mold which was found also in the straw. The immediate removal of this litter and the introduction of clean straw checked the illness of the fowls.

These considerations point to the necessity of keeping the chicken feed free from mold; for example, moldy feed and meat scrap that "smells bad." With the latter, cases of bacillary diarrhea or toxic conditions similar to that known as ptomaine poisoning may be expected. If, in spite of the utmost care, as may sometimes happen, mold should creep into grain which it is compulsory to feed, treat it as the housewife has for years treated such accidents—by applying strong heat. There is immense satisfaction in realizing that the day is past when it was thought that moldy grain which could not be used by human beings would do for the horse, what was too bad for the horse would do for the cow, what was too bad for the cow would do for the hogs, and that which the farmer would not dare give to the hogs might be thrown to the chickens.

5. Clean eggs.—The reason for dipping eggs, just prior to incubation, in grain alcohol is the fact that as they come from the hen

they are compelled to pass through the cloaca, which gives passage likewise to the droppings. Thus the exterior of the eggshell is certain to be contaminated with whatever infectious microbes are lurking in the intestinal tract of the hen. If, as is very likely to be the case, the hen is parasitized with coccidia, the shells of her eggs are certain to be contaminated with the coccidial cysts, which under the influence of the heat and moisture of the incubator develop to the stage necessary for the transfer of the disease to the chick. Then, when the chicks begin to peck, as peck they will, during the first 24 hours, some of these cysts will be taken into the alimentary tract and, upon reaching the duodenum (that portion of the intestine immediately following the gizzard), will be dissolved by the pancreatic juice, so setting free the coccidial forms that attack the lining membrane of the intestine and thus precipitating an outbreak of white diarrhea in the flock. There are many poultry breeders who are prepared to vouch for the marvelous results that have followed the cleansing of eggs just prior to incubation. However, the eggshell is not the only source of the contagion of white diarrhea, so that merely dipping eggs and then continuing to be careless on all the other points is not likely to be a sufficient preventive.

6. Clean incubators and brooders.—The chief necessity for this is because previous use has tended to infect them. For instance, the infected eggs of a first hatch may not have been dipped, although through some fortunate combination of unrecognized factors the chicks did not come down with the disease; nevertheless, the organisms are there. Again, in view of the widespread infection of adult stock by coccidia, and the writer's demonstration of the causative relation of these coccidia to the almost universally prevalent white diarrhea of chicks, every poulterer should act on the assumption that his adult stock is infected, that therefore the eggshells have been contaminated, and hence that a previously used incubator needs disinfection.

7. Clean breeding.—Consideration of a few facts will demonstrate the advisability of breeding with the youngest females consistent with all known principles of good breeding. A few years ago the writer made the announcement that so-called brooder pneumonia is caused by the presence of a mold, *Aspergillus fumigatus*, in the lungs of the chicks. That was the demonstration that brooder pneumonia is a pulmonary aspergillosis. The writer has examined cases dead within 24 hours after hatching in which more than half the lung tissue has been transformed into a solid, cheesy mass. Such a condition could not have developed after hatching. The time necessary for the development of such lesions would carry the starting point back into the period of incubation, hence the only possible method of accounting for such early disease would be to suppose the presence of

the mold within the egg and its development in the egg along with the embryo, the conditions of incubation being ideal for mold development. That eggs may carry mold infection has long been known. Gayon, in 1875, reported finding in eggs a mold which appears to have been *Aspergillus fumigatus*. Since that time several investigators have noted the presence in eggs of this pathogenic mold. More recent investigations have revealed also the presence of various bacteria, both harmless and disease-producing, in the egg contents.

The question now arises as to how and where this infection of the egg occurs. It is known that infection of the egg may take place by passage of the microbes through the shell from the outside. Eggs kept in damp places are known to be thus infected with molds, while eggs whose shells have been allowed to remain in a filthy condition have revealed a bacterial infection of their contents in marked accord with the microbic contamination of the outside of the shells.

Some very recent experiments have shown that the eggs of virgin pullets reveal a much lower rate of bacterial infection than eggs from females that have been associated with the male bird. The act of copulation as carried out among fowls always results in the introduction of more or less dirt into the oviduct of the female, thus entailing gradual infection of the egg tube and ovary with microbes found in the soil contaminated with poultry droppings, to say nothing of the transfer from the cock bird's cloaca of pathogenic microorganisms derived from his own intestinal tract. It has long been recognized in a general way that infertile eggs did not suffer putrefaction in the incubator, while fertile eggs that did not go on to the development of the embryo were quite prone to become rotten.

The investigations referred to furnish us with the exact status of this question. There are infertile eggs other than those from virgin pullets, but it is not so much the infertile eggs as the eggs from virgin pullets that are free from infection. And here the poultryman's judgment and experience placed him on ground which the bacteriologist has now justified. Knowing from other and extensive investigations that constant breeding from pullets resulted in deterioration of the stock, poultrymen have taken to using their pullets merely as layers, reserving them for breeding only after the pullet age was passed. Then, as stated above, believing that infertile eggs did not spoil as quickly as fertile eggs, they decided that it was best to keep these laying pullets apart from the male bird. These investigations have justified this course and have also demonstrated that immediately upon association with the male bird the females are in danger of infection of the egg tube and egg bag and consequently of the egg itself. Recognizing this possibility that constantly menaces the breeding birds as against the layers, if disease persists among the chicks in spite of cleaning out the intestines of the old birds, and spreading lime about the place and cleansing the water supply, and dipping the eggs prior to incubation, and disinfecting the incubators and brooders, the poultryman should look to the breeding stock. It must be remembered that from the moment a hen is mated there arises the possibility of infection of the reproductive organs which may be transmitted to the egg and so to the embryo, causing either death in the shell or of the newly hatched chick. All mated birds must therefore be regarded as potentially infected.

The experiments of Rettger and Stoneburn at Storrs Agricultural Experiment Station in the investigation of *Bacterium pullorum* are conclusive as to the transfer of disease-producing microbes from the ovary of the hen to the egg and thence to the embryo, thus causing death of the embryo in the shell or a fatal septicemia of the newly hatched chick.

APPLICATION OF THE MAXIMS TO THE TREATMENT OF DISEASE.

It must not be imagined that all necessary treatment of disease begins and ends with the employment of the seven maxims which have been enunciated in this paper. These primary principles have their place as the basis of all successful treatment. In many cases they might, very likely should, prove sufficient in themselves. Frequently, however, they must constitute only the foundation upon which a complete and efficient treatment may be built. Hence it seems wise at this point to present somewhat in detail the application of these maxims in the treatment of some of the diseases of poultry. Fortunately, most of the important diseases may be so grouped as to permit suggestions for the intelligent application of these maxims to any disease. Such, it should be understood, is the sole object of this section. It is not a manual of treatment; it is, rather, a mere outline of treatment of some representative groupings of poultry ailments for the purpose of incorporating the maxims studied above and of showing their relation to whatever specific treatment—local or general—may be adopted.

DISEASES OF THE REGION OF THE HEAD.

The one prominent disease group that occurs to the mind in connection with this title is that collection of ailments known under the general term of "roup." This name includes for the writer all affections usually so designated by poultrymen in different parts of the country, namely, snuffles, wet nose, cold in the head, contagious catarrh, sore eyes, cold in the eyes, roupy disease of the eyes, diphtheritic sore eyes, sore mouth, sore throat, roupy disease of the mouth, diphtheritic sore mouth, chicken diphtheria, diphtheritic roup, and canker. Being an infectious disease, roup is caused by microbes, not by drafts or dampness. These latter are predisposing factors which operate, as in a common cold, by furnishing conditions favorable for the multiplication of the roup germs. Hence, for the purposes of this paper, roup should be before the mind in treatment when there occurs in birds any deviation from the normal in the condition of the eyes or upper air and food passages, whether it be watering of the eyes, running at the nose, or slobbering, on the one hand, or, on the other hand, the presence in eye, nostrils, or mouth of yellowish, cheesy material, and (note this particularly) whether, with any or all of these symptoms, there is or is not an odor.

Without doubt the only safe treatment of roup is to kill the sick birds by a bloodless method, immediately burn their carcasses, and then, directing attention to the apparently healthy birds, clean out, clean up, and clean the water supply as previously directed in maxims 1, 2, and 3.

If, however, the poultryman for any reason desires to treat the sick birds, they should be isolated at once, kept at a safe distance from the flock, and visited only after the healthy birds have received their usual attentions. The poulterer immediately on leaving the hospital should change or disinfect his shoes, remove his hospital overalls, and thoroughly wash his hands and clean his nails. He must keep constantly before his mind the fact that he is maintaining a pesthouse on his premises, and everything must be done to prevent transfer of the contagion from sick to well.

For the birds which are apparently well it is sufficient to clean out once a week, clean up by a liberal use of air-slaked lime, and clean the water supply daily. In the treatment of the isolated sick birds the indications are to clean out, clean up, clean water supply, and apply local treatment (Epsom salt may be administered twice and even three times a week until signs of improvement are manifested). Local treatment will vary according to the different phases assumed by the disease. Nevertheless, all portions of the upper air and food passages should receive some attention. This is required by the intimate relationship existing between mouth, throat, gullet, windpipe, cleft palate, nostrils, orbit, and groove (sinus) surrounding the orbit.

In all cases, by means of a medicine dropper or a small oil can, inject into the nostrils a few drops of peroxid of hydrogen. Flush the eyes with a saturated (4 per cent) solution of boric acid (1 heaping dessert-spoonful to 1 pint of water, preferably boiled water), or with a wash composed of 1 heaping dessert-spoonful of powdered borax to 1 pint of water. Remove all cheesy matter by means of a thin probe covered with absorbent cotton and wet with the solution of boric acid or borax. The mouth and throat should be swabbed freely with a mixture of equal parts of peroxid of hydrogen and boiled water. Cheesy matter in the cleft palate and canker patches in the mouth should be scraped away and the exposed surfaces painted with peroxid of hydrogen. Swellings under or around the eye are phases of roup and are best treated locally by injections into the nostrils and incision of the skin over the center of the lump, when, by a little pressure, the contents usually roll out like the yolk of a hard-boiled egg. The cavity may be painted with tincture of iodin.

Chickenpox, or sorehead, is by some eminent investigators regarded as another manifestation of roup. Others equally prominent doubt the identity of the two affections. It is, however, a contagious disease, and, if treated, should be dealt with upon the principles outlined above for roup. The indications are to clean out, clean up, clean the water supply, and apply local treatment. This last consists in removing the warts or scabs as they form on the comb or unfeathered portions of the head and paint the exposed surfaces with turpentine or tincture of iodin.

DISEASES OF THE INTESTINES.

This disease group equals in importance that previously considered. In fact, when chicks, as well as older birds, are taken into account, intestinal affections cause a much greater mortality. The various affections belonging to this group are so generally characterized by diarrhea as the prominent symptom that the name "diarrhea," with various prefixes (white, pasty, bacillary, protozoal, coccidial, flagellate, verminous), is apt to be the more common designation. Whatever the character of the disease, whether it presents the symptom of diarrhea or of constipation, whether it appears to be a mere disturbance of the digestive apparatus from improper feeding or a manifestly infectious malady, it must be understood that after a few days the disturbance takes on the character of a local intestinal infection, due to the multiplication of microorganisms in the intestinal tract. Hence all indications for treatment must be based on the possibility of infection either present or imminent. These indications are met by maxims 1, 2, and 3—clean out, clean up, and clean the water supply. If the intestinal disturbance has been induced by moldy or otherwise improper feed, further treatment, as indicated in maxim 4, is called for, namely, stop feeding the contaminated material; or if compelled to continue, apply strong heat to the moldy feed stuff.

It is doubtful if a complete cure is ever effected in cases of infectious diarrhea. Some of the infective organisms are apt to become permanently located in some portion of the intestinal tract. As a result the cloaca becomes contaminated with these microbes, and consequently there takes place a pollution of the eggshell in its passage through the cloaca. Hence the next indication is met by maxim 5, cleanse eggs in grain alcohol just before placing them in the incubator. Moreover, since there is always the possibility of a mild attack of one of these infectious diarrheas having escaped the poulterer's notice, with the result that eggs from a hen which has thus suffered have been placed uncleansed in the incubator, a further indication for treatment in the overcoming of diarrheal affections in poultry calls for the treatment required by maxim 6, clean incubators and brooders. Sooner or later, if these affections persist in the flock, the poultryman must recognize the value of maxim 7, clean breeding by using the youngest females consistent with the requirements governing the production of vigorous stock.

Before starting in on a course of treatment like the above the poulterer should consider whether the sick birds are worth the trouble. He should also consider whether he can afford to risk the exposure of his healthy birds to the dangers incident to the presence of disease upon his premises. Whichever way he decides, he must undoubtedly see that it is better to apply the seven maxims of this paper as a preventive measure than wait to adopt them as a basis of treatment. He must further remember to quarantine all new birds, and neither introduce into the flock nor allow to remain in it any bird that shows watery eyes, running at the nose, noisy breathing, or soiling of the feathers around the vent. Such birds, in all probability, suffer from roup or intestinal infection in mild form, yet are able to disseminate the causative agents of the disease throughout the flock.

FIBERS USED FOR BINDER TWINE.

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INTRODUCTION.

Binder twine is used to tie into bundles nearly 90 million acres of small grain harvested annually in the United States. In addition to the sheaves of wheat, oats, barley, rye, rice, and flax, which are cut by the grain binders, increasing areas of corn are being harvested by corn binders. The quantity of twine required varies widely for light or heavy crops and for different crops, also for different kinds of twine, but as an approximate average it may be estimated at about 2 pounds per acre for small grain and 3 pounds per acre for corn. More than 190 million pounds of binder twine are used annually in the United States. The farmer pays for this more than $15,-000,000. This twine is used but once and in its use is destroyed. Hay rope may be used over and over again before being worn out, and after that it may be converted into paper stock. But not so with binder twine. No attempt is made to recover it for any purpose, and in one operation it uses up completely more than 90,000 tons of new fiber each year. The demand for binder twine has been a most important factor in the development of hard-fiber production. During the 35 years since self-binders came into general use for harvesting grain in the United States, the production of fiber from the henequen plant in Yucatan has increased more than sevenfold.

REQUIREMENTS OF BINDER-TWINE FIBER.

A fiber to be used for binder twine must be strong, rather stiff, averaging more than 30 inches long, clean, and straight, not subject to injury by moisture, mildew, or insects, and it must be comparatively inexpensive. These requirements are best fulfilled by the hard fibers, abacá (Manila hemp), henequen, sisal, cantala, cabuya, and phormium, and to a less degree by the soft fibers, flax, hemp, and jute. Cotton, which has a wider range of uses than any other textile fiber, is not suitable for binder twine. All of the hard fibers used in the manufacture of binder twine are imported (See Pl. III, fig. 1.)

The principal kinds of binder twine quoted in the markets are the following:

(1) Pure manila (650 feet to the pound), made of a good quality of abacá fiber.

(2) Manila (600 feet to the pound), made of abacá with a mixture of other fibers.

(3) Standard manila (550 feet to the pound), made of mixed abacá and henequen fiber.

(4) Standard (500 feet to the pound), made of henequen (sisal) colored to resemble abacá.

(5) White sisal (500 feet to the pound), made of henequen fiber, sometimes with a mixture of other fibers, but not colored.

Abacá, commonly called "Manila hemp," and henequen, known as "sisal" in the trade, are used for binder twine more than all other fibers combined. (Pl. III, fig. 1.) Other hard fibers used to a limited extent, chiefly for mixing with abacá or henequen, are sisal, phormium, Manila maguey, mescal maguey, cabuya, and mauritius.

ABACÁ.

The best and highest priced grades of binder twine are made of abacá.[1] This fiber is obtained from the leaf stems of the abacá plant (*Musa textilis*). (Pl. V, fig. 1.) The abacá plant is nearly related to the banana plant, which it very closely resembles, except that its fruit is not edible. It is native in the warm, rainy districts of the Philippines, where, in many localities, it is still abundant in the wild state. The abacá fiber of commerce is obtained exclusively from plants that are cultivated. Attempts have been made to introduce the cultivation of abacá into southern India, the Andaman Islands, Borneo, Cuba, and Porto Rico, but owing to unsuitable conditions of soil or climate or to lack of facilities for preparing the fiber, the industry has not become established outside of the Philippines, except in Java.

The cultivation of these plants, of which about a dozen horticultural varieties are recognized, is confined to limited, warm, moist areas in the Philippines and Java. Abacá requires for successful growth a rich, deep, loamy soil of rather loose texture, moist, yet with good drainage. It must have a rainfall of 60 inches or more, well distributed, so that there may be no severe drought at any season, but the drainage must be such that the water will not remain stagnant about its roots. Many of the best plantations in the Philippines are on volcanic soils, near the bases of mountains sloping south and east, where there is abundance of rain, good drainage, warm sunshine, and protection from strong winds.

Abacá plants produce seeds in black, bananalike fruits, but they are commonly propagated by suckers which spring up from the roots.

[1] The name abacá is preferred to Manila hemp because neither the plant nor the fiber bears any relation to true hemp.

These are set out in rows about 8 feet apart each way, and the soil around each plant is kept free from weeds by hand cultivation with the bolo or hoe. On some of the well-managed plantations better results are obtained by thorough, clean cultivation with cultivating tools drawn by mules. The plants attain a height of 15 to 20 feet.

The first stalks are cut about 18 months after setting out the suckers. The leaves are trimmed off, leaving the trunk 8 to 12 feet long and 5 to 8 inches in diameter, composed of the leaf stems overlapping in concentric layers, extending nearly from base to summit. The trunk is separated into these component leaf stems 6 to 10 feet long, 5 to 8 inches wide, and about three-eighths of an inch thick. The leaf stems in turn are split into strips 1 to 2 inches wide and the spongy inner portion is scraped away, as the good fiber is only in the thin outer layer of each successive sheathing stem. The thin, flat ribbons, or "tuxies," thus prepared are drawn by hand under a blunt knife pressed by a spring against a wooden block. This process scrapes away the pulp, leaving clean white abacá fiber. The fiber is dried in the sun and after sorting is ready to be baled for market.

Twelve different grades of abacá are quoted on the market, the differences resulting chiefly from greater or less care in cleaning and preparing the fiber. These grades range in price from about 5 cents per pound for the lowest to about 10 cents for the highest. Most of the "pure manila" binder twine is made of the "midway," or medium, grade, ranging between the grades known as "fair current" and "good current."

HENEQUEN.

The largest quantity of binder twine is made of fiber obtained from the leaves of the henequen plant (*Agave fourcroydes*). (Pl. IV, fig. 1.) This fiber is commonly known in the trade as "sisal," because it was formerly shipped from the port of Sisal in Yucatan, but it is different from the fiber of the true sisal plant. Henequen is native in southeastern Mexico, and it is cultivated in Yucatan and Campeche and to a limited extent in the States of Chiapas, Sinaloa, and Tamaulipas, Mexico, and also in Cuba. It is rarely seen outside of these regions. It requires a hot, dry climate and well-drained limestone soil. In Yucatan, where it thrives best, the lowest recorded temperature is 48° F., and the annual rainfall is about 30 inches. The atmosphere is very dry, except when it is actually raining, and the porous limestone soil affords excellent drainage. This soil also permits free access of air to the roots, which is necessary for the best development of henequen.

Henequen plants produce seeds and bulbils, similar to top onions, but they are propagated chiefly by suckers which grow from the root-stocks. The suckers are set out in rows about 9 feet apart and about 6 feet apart in the row. The vegetation between the plants is kept down usually by cutting with machetes. Better results are obtained by clean cultivation where the land is not too stony.

The first crop of leaves is cut 4 to 7 years after planting, usually the sixth or seventh year in Yucatan, and after that annual or semi-annual crops are cut for 10 to 20 years. Only the two outer or lower rows of leaves are cut at each harvest, leaving the others to develop. The spines on the point and margins are trimmed off and the leaves are tied in bundles of 50 each and taken to the cleaning machines. Nearly all of the henequen fiber of commerce is cleaned by machinery within 48 hours after the leaves are cut. Most of the machines work on the same general principle. The leaves, fed side-wise in a continuous row at the rate of 3,000 to 30,000 an hour, are grasped near the center and carried forward past a rapidly revolving wheel with scrapers which beat and scrape away the pulp from one end of the leaf. The grasping device is then shifted to the cleaned fiber, and the leaf is carried on past another wheel which scrapes away the pulp from the other end of the leaf. (Pl. V, fig. 2.) The fiber, cleaned in this manner in about six seconds, is dried in the sun and is then ready to be baled for market. This fiber is of a light reddish yellow color and 3 to 4 feet long. It is delivered at the mills in the United States at 4 to 6 cents per pound.

SISAL.

The true sisal fiber is obtained from the leaves of the sisal plant (*Agave sisalana*). (Pl. IV, fig. 2.) This plant is native in southern Mexico and Central America. It is cultivated for fiber production in the Bahamas, Hawaii, German East Africa, and on a few plantations in India and in Chiapas, Mexico, but in Yucatan it is cultivated to only a small extent for the production of fiber for domestic use. It is more widely distributed in gardens and collections of economic plants than any other fiber-producing Agave. It is often incorrectly labeled "*Agave rigida sisalana.*" It will endure slight frosts and a considerable variation in soil and moisture better than henequen, but for profitable fiber production it should be cultivated only in dry limestone soils in regions where the temperature does not fall below freezing.

Sisal produces suckers and bulbils, as does henequen, but no seeds. The bulbils, and usually the suckers, are cultivated 6 months or more in a nursery before being set out in the field. When 15 to 20 inches high they are transplanted to the field and set out in rows 6 to 9 feet apart. The first crop of leaves is cut 3 to 5 years after transplanting, and annual or semiannual crops are obtained for 4 to 10 years thereafter. Much of the sisal fiber in the Bahamas is cleaned by hand after the leaves have been soaked in water to soften the pulp. This produces a dull-gray or dingy-colored fiber of poor quality. The best sisal is cleaned by machinery in the same manner as henequen. When properly cleaned it is clear, ivory white, with a good luster, and it is stronger than henequen. Well-cleaned sisal commands a price somewhat better than henequen, and it can be used to better advantage in higher grades of cordage than binder twine, while the hand-cleaned sisal is too poor to be made into binder twine, except for mixing in the lowest grades.

PHORMIUM (NEW ZEALAND HEMP).

Phormium, also called New Zealand hemp and flax, though not at all like either hemp or flax, is obtained from the leaves of *Phormium tenax* in New Zealand. (Pl. III, fig. 2.) This is the most important hard-fiber plant outside of the Tropics. It is cultivated as an ornamental plant in parks in California and on the Atlantic coast as far north as Charleston, S. C. It is not cultivated systematically in New Zealand, but is left in a semiwild state when the land is cleared of other vegetation. It grows in moist, rich land and in reclaimed swamps, forming dense clumps 2 to 4 feet in diameter. The leaves are 4 to 10 feet long, $1\frac{1}{2}$ to 2 inches wide, and about one-sixteenth of an inch thick, with a rather firm texture and a hard surface, making it difficult to scrape away the pulp without injury to the fiber.

The fiber is prepared by beating, soaking in water, scraping, drying, beating a second time, sorting, and baling. This fiber, as commonly prepared in New Zealand, is 4 to 8 feet long, reddish yellow in color, finer and softer, but much weaker than abacá. It resembles abacá more nearly than any other fiber and may be mixed with it in spinning, but it is too weak to be used alone for binder twine.

Phormium and abacá may be distinguished from henequen and sisal fibers by burning and noting the color of the ash, that of abacá being almost black, phormium very dark brownish gray, and henequen and sisal light gray or nearly white. Sisal from Java, entering our market in small quantities, probably yields a dark ash because it is grown on soil containing little lime.

MAURITIUS.

Mauritius is a hard fiber, white in color, finer and more flexible than either henequen or abacá, obtained from the leaves of aloes vert (*Furcraea foetida*) in the island of Mauritius. This plant, native in eastern Brazil, is cultivated for fiber production in Mauritius and, to a limited extent, in India. The plant grows like sisal, but has much larger leaves, measuring 4 to 8 feet long and 6 to 8 inches wide, with a small, blunt, horny tip. Two forms are recognized in Mauritius, "aloes malgache" (*Furcraea foetida*) of the highlands, and "aloes creole" (*Furcraea foetida willemetiana*) of the lowlands. The lowland form is preferred for fiber production, although its leaves are more disagreeable to handle because of the sharp, hooked spines along their margins.

The fiber is prepared by beating, soaking, scraping, washing with soap and water, drying, and beating again. This laborious method produces a very white, flexible fiber, capable of absorbing more than its weight of oil, but too weak to be used alone for binder twine. It may be useful for mixing with other fibers to improve the color of twine or to increase its capacity for holding oil.

CABUYA.

Cabuya fiber, produced to a limited extent in Costa Rica and occasionally quoted in the markets as "Central American sisal," may be used for binder twine. It is obtained from the leaves of the cabuya plants (*Furcraea cabuya* and *Furcraea cabuya integra*). These plants are now being cultivated in Costa Rica, but thus far the fiber, cleaned by hand, has been inferior to that from Yucatan henequen. When properly prepared it is longer and stronger than henequen fiber.

MANILA MAGUEY.

Manila maguey is a comparatively new fiber in the market. It is produced in the Philippines from the leaves of the Manila maguey plant (*Agave cantala*). This agave, although undoubtedly native in the American Tropics, is known only in the East Indies, and within the last decade it has been cultivated on a commercial scale in the Philippines and Java. The plant is known in Java as "nanas sabrang" and "cantala." It is there cultivated on large plantations like henequen in Yucatan, and its fiber is prepared by the same kind of machines. In the Philippines most of the Manila maguey is prepared by hand, and the quality of the fiber is injured by soaking the leaves in water to facilitate the work of hand cleaning. In India this plant is used for hedges along railways and roadsides. The leaves collected from these plants and treated by crude hand methods produce a large proportion of the fiber known in the market as "Bombay aloe."

The fiber when properly cleaned is whiter, finer, and more flexible than henequen. It is used to a limited extent in binder twine, chiefly for mixing with other fibers.

MESCAL MAGUEY.

Mescal maguey, a fiber similar to henequen but finer and softer, is produced in the State of Sinaloa in western Mexico from the leaves of the mescal maguey plant (*Agave* sp.). This plant is cultivated primarily for the production of the strong alcoholic drink "mescal" distilled from its base. In recent years its leaves have been used for the production of a fiber of good quality. This fiber is used chiefly in the cordage and twine mills on the Pacific coast. It has often been suggested that this plant be introduced in arid regions of the Southwest, but it will not grow successfully where the temperature falls below freezing.

ZAPUPE.

In eastern Mexico, in the States of Tamaulipas and Vera Cruz, three agaves, known respectively as "zapupe azul," or blue zapupe (*Agave zapupe*), "zapupe de Tepetzintla" (*Agave lespinassei*), and "zapupe verde" (*Agave deweyana*), are cultivated. These plants grow well on loamy soils with more moisture and less lime than seem necessary for good results with henequen or sisal. Otherwise they are cultivated in much the same manner and the fiber is cleaned by the same kind of machine. The fiber from these three different species differs somewhat, but it is all softer and finer than henequen.

FLAX.

Flax fiber is used in the manufacture of 2,000 tons or more of binder twine each year. Only the better grades of clean straight flax straw can be successfully used for this purpose. Much of the flax grown for seed is too short and too weedy to be used for binder twine. The straw, with the seed, is purchased in bundles, baled, and shipped to the mill, where it passes through a series of automatic machines which thrash and clean the seed, break, scutch, and partly hackle the fiber, then mix with it a small percentage of hard fiber to give it added strength and rigidity. After this it is passed through the drawing frames and spinning machinery, being finally delivered in the form of finished balls of binder twine, ready for the harvest.

HEMP.

Kentucky hemp has been used in the manufacture of binder twine, both alone and in connection with jute, but owing to the scanty and somewhat uncertain supplies its use has been discontinued. Jute alone is not sufficiently strong, and is especially liable to deterioration if exposed to rains while the grain is standing in shock, and hemp alone is too expensive at normal prices to compete successfully with abacá and henequen.

MISCELLANEOUS FIBERS.

The fibers of the various species of yuccas, generally known as beargrass, and also the lechuguilla, a small agave abundant in western Texas, are often suggested as fibers for binder twine, but they are too short and otherwise unfit for the purpose.

Flax and hemp, and possibly phormium, are the only plants producing fibers at all suited for binder twine that may be successfully cultivated in the United States, exclusive of Porto Rico, Hawaii, and the Florida keys. The arid lands of the Southwest are often suggested for this purpose, but the winters there are too cold for the successful growth of any of the agaves now cultivated for fiber production. Sisal is now successfully cultivated on arid lands in Hawaii, producing fiber of the best quality. Sisal, henequen, and zapupe introduced into Porto Rico have grown well, giving excellent promise for the profitable cultivation of these plants in parts of that island too dry for other crops. Sisal, zapupe, and cabuya introduced on the Florida keys have made an excellent growth where they are on land sufficiently high to escape being covered with salt water during the hurricanes.

The importations of henequen (the sisal of the market) have increased from 39,000 tons in 1891 to more than 117,000 tons in 1911, and of abacá (Manila hemp) from 35,000 tons to 74,000 tons during the same period. These increased supplies have come chiefly from the increased production of henequen in Yucatan and abacá in the Philippines, but should the market demand a similar increase during the next 20 years there is little danger of a lack of supply, for new areas are being found where these and similar fibers may be successfully produced.

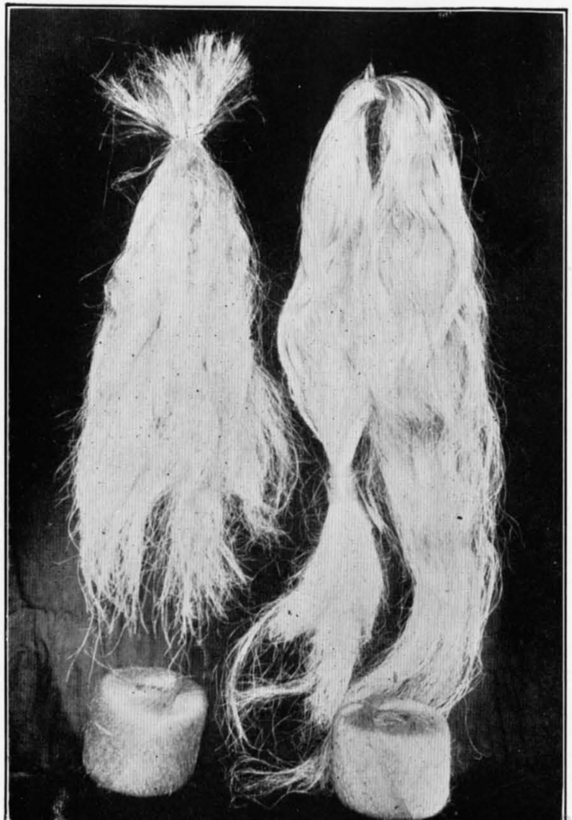

FIG. 1.—TWO MOST IMPORTANT BINDER-TWINE FIBERS.

[Henequen (at left), with ball of "standard sisal" twine. Abacá (at right), with ball of "pure manila" twine.]

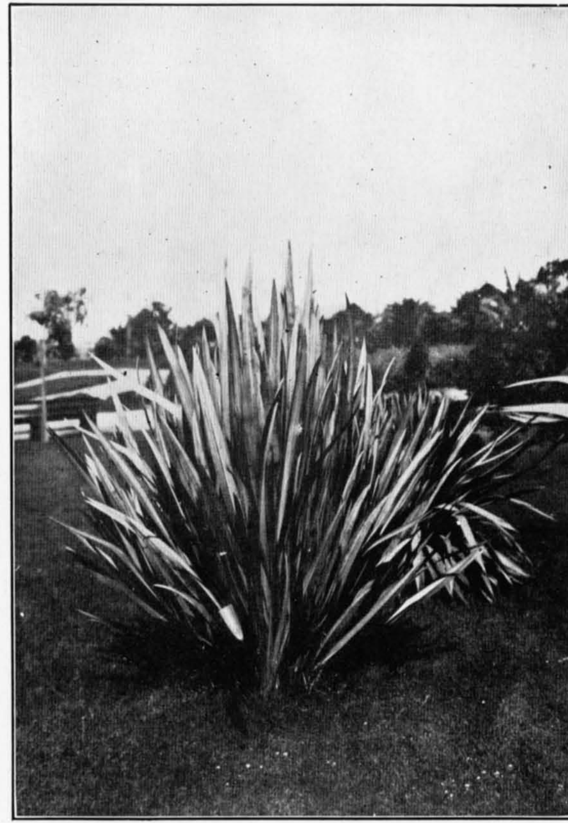

FIG. 2.—PHORMIUM (CALLED NEW ZEALAND HEMP AND FLAX, BUT UNLIKE EITHER).

[Fiber similar in appearance to abacá, but weaker, is obtained from the leaves.]

FIG. 1.—HENEQUEN, THE MOST IMPORTANT SOURCE OF BINDER-TWINE FIBER.
[Two rows of leaves are usually cut twice each year in Yucatan.]

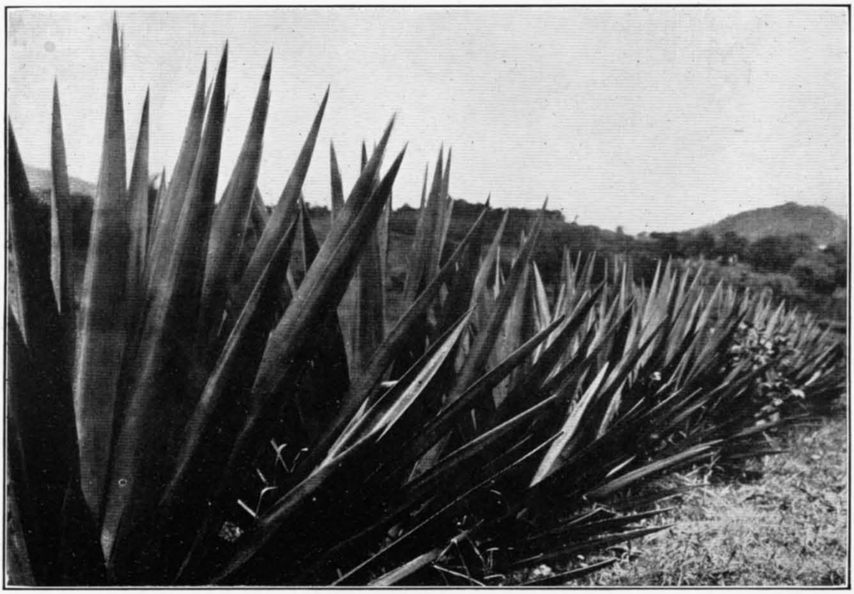

FIG. 2.—SISAL, CULTIVATED IN THE BAHAMAS, HAWAII, AND GERMAN EAST AFRICA.
[Differs from henequen in spines, color, and form of leaf and is shorter-lived, but yields better fiber.]

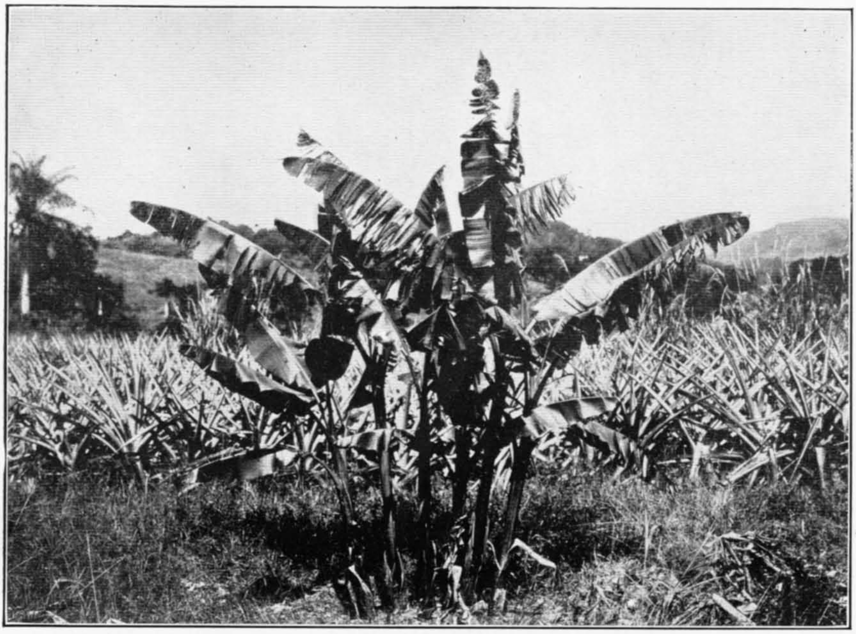

FIG. 1.—ABACÁ (MANILA HEMP), INJURED BY WIND.

[Fiber obtained from the overlapping leaf stems composing the trunk of the plant.]

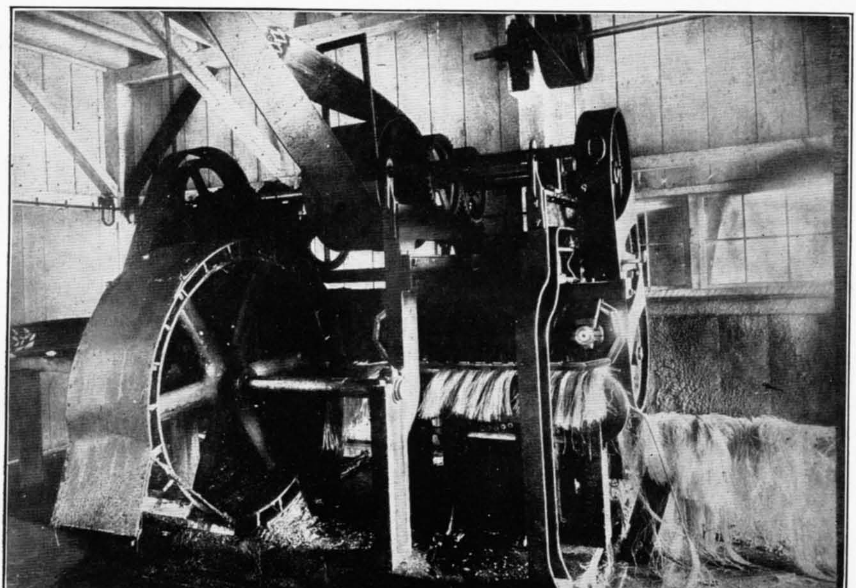

FIG. 2.—MACHINE FOR CLEANING FIBER FROM HENEQUEN AND SISAL LEAVES.

[The leaves, fed sidewise, are carried past the first wheel, cleaning the lower half; then the grip changes to this cleaned fiber, carrying them past the second wheel, cleaning the upper half.]

RELATION BETWEEN ROTATION SYSTEMS AND INSECT INJURY IN THE SOUTH.

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INTRODUCTION.

One of the most conspicuous features of the recent remarkable awakening in agriculture in the South is the movement toward the diversification of crops. To a large extent this movement is the direct result of the invasion of the cotton belt by the boll weevil, although forces have been at work for many years which alone would have eventually brought about a change from the older system under which crop diversification received but little consideration. As it is, planters have learned that cotton can not now be planted profitably in certain situations. In the Mississippi Valley, for instance, there are large areas where cotton was formerly cultivated very successfully, but upon which the crop can not now be grown with any degree of certainty. These conditions force the planters to reduce the acreage in cotton, devoting to that crop only such areas as are favorable for the fight against the boll weevil. The lands from which cotton is excluded in the manner described are devoted to a considerable variety of other crops.

The great majority of insects which affect southern field crops are not restricted to a single plant. Certain practices in rotation tend to increase the numbers of the pests, and certain other practices tend strongly to hold them in subjection. Consequently the new era in the South brings special entomological problems. It is recognized by everyone that the main object of a system of rotation of crops is to maintain or upbuild the fertility of the soil. Fortunately it is not absolutely necessary in many cases for fixed sequences of crops to be followed. In many systems the planter has considerable discretion as to the specific crops that are to follow in the rotation. The discretion the farmer thus enjoys gives him an opportunity greatly to decrease insect injury in connection with his practice of rotation. An attempt will be made in this paper to point out some of the general considerations that must be taken into account in connection with rotation practices which are coming to be generally followed in the Southern States.

LIMITATIONS TO POSSIBILITIES OF INSECT CONTROL BY ROTATION PRACTICES.

Before proceeding further it is necessary to point out the fact that there are important limitations to the extent to which insects may be controlled by rotation. It must not be thought that any system of rotation is a panacea for damage by insects. As a matter of fact, there are decided limitations to the application of this means of control. Some species, as the boll weevil, the bollworm, and the tobacco hornworms, to a large extent are not amenable to control by rotation. Climatic conditions and the attacks of parasites result in frequent irregularity in insect abundance. Sporadic outbreaks which can not be forecasted are of not uncommon occurrence. Moreover, by flight or by crawling, invasions take place from fields that are entirely outside of the areas concerned in the rotation if not from fields beyond the control of the individual farmer. Thus, the rice-root weevils come into the fields in swarms from uncultivated lands. The grass worm may do the same. The red spider may come from certain weeds, the army worm from waste places, and the sugar-cane borer from Johnson grass growing on headlands or levees, not to mention grasshoppers which may fly in from great distances. In fact, there are no very important barriers on the plantation which serve to prevent the spread of any species which can fly or crawl. This fact will always make it necessary for the planter to combat insects by direct means. Rotation has a definite and important place in insect control, especially in the case of species which develop in the ground, but it is far from being a universal remedy. The obstacles are increased by the fact that there are definite limitations in the practice of rotation itself. Certain soils, for example, are better adapted to corn than to cotton, or to peanuts than to cowpeas. The futility of attempting to produce crops not adapted to the soil is well known to the planter. Moreover, market conditions will frequently compel planters to depart from a system of rotation upon which they may have started. These conditions will always remain general obstacles to any system of rotation which might be ideal from the standpoint of insect control.

PRINCIPAL INSECTS AFFECTING SOUTHERN FIELD CROPS.[1]

The more important insect enemies of the southern field crops considered in this paper are indicated below:

The cotton boll weevil (*Anthonomus grandis* Boh.).

The cotton bollworm or corn budworm (*Heliothis obsoleta* Fab.).

[1] Under this heading we consider only some of the more important insect enemies of cotton, corn, tobacco, rice, and sugar cane. Of course there are additional important pests of the other field crops grown in the South, but for the present purpose we exclude the special pests of cereals and of such crops as alfalfa and sorghum, which are grown primarily for forage.

The tobacco hornworms (*Phlegethontius* spp.).
The cotton aphis (*Aphis gossypii* Glover).
The cotton worm or caterpillar (*Alabama argillacea* Hübn.).
Cutworms of several species.
The southern corn rootworm, or budworm (*Diabrotica 12-punctata* Oliv.).
The army worm (*Heliophila unipuncta* Haw.).
The grass worm (*Laphygma frugiperda* S. and A.).
The corn and cotton root-aphis (*Aphis maidi-radicis* Forbes).
The garden webworm (*Loxostege similalis* Guen.).
The tobacco and corn stem-borer (*Crambus caliginosellus* Clem.).
The cotton wireworm (*Horistonotus curiatus* Say).
The sugar-cane borer (*Diatræa saccharalis* Fab.).
The cotton red spider (*Tetranychus bimaculatus* Harvey).
The cowpea-pod weevil (*Chalcodermus æneus* Boh.).
The rice-root weevil (*Lissorhoptrus simplex* Say).

It is a striking fact that in this list of injurious species there are but two which are restricted to a single plant. These are the cotton boll weevil and the cotton caterpillar. All of the others attack one or more of the cultivated plants, or at least one cultivated plant and certain weeds or grasses not cultivated. As a matter of fact the rice-root weevil is the only species, aside from the boll weevil and the cotton worm, which does not affect more than one cultivated plant. In the case of the rice weevil several species of grass are attacked. As these grasses spring up in and about cultivated fields or when the fields are allowed to lie fallow they must be taken into consideration in connection with plans for rotation.

PLANTS ATTACKED BY INSECTS INJURIOUS TO SOUTHERN FIELD CROPS.

As has just been pointed out, there are but two exceptions to the rule that insects of importance in connection with the cultivation of southern field crops are not restricted to a single plant. In this connection we shall outline briefly the feeding habits of the species considered in this paper.

The bollworm attacks corn, cotton, tomatoes, okra, tobacco, and other plants. The tobacco hornworms feed upon tomatoes and allied plants, as well as upon potatoes. The cotton aphis breeds upon all plants of the cucumber family, as well as upon cotton, beans, strawberries, oranges, and many other cultivated and uncultivated plants. Cutworms of four or five species attack corn, grass, and truck crops, as well as cotton. The southern corn root-worm, or drill worm, according to Dr. F. H. Chittenden, is especially partial to cereals, but frequently causes considerable injury to corn. The grass worm attacks various species of grasses, as well as rice, corn, sorghum, and cotton. The cotton root-aphis feeds upon corn as well as cotton and undoubtedly upon certain other plants. The garden webworm attacks alfalfa, many truck crops, and cotton, as well as a long list of other cultivated and uncultivated plants. The tobacco stem-borer also attacks corn. It is an important pest of that crop and is to be found breeding in certain weeds. The cotton wireworm feeds upon corn as well as cotton and undoubtedly attacks a considerable number of uncultivated plants. The sugar-cane borer in Louisiana attacks corn, as well as Johnson grass. Corn is exceedingly important in contributing to the increase of this species, as the first broods of the season are reproduced upon that plant. The cotton red spider is practically omnivorous. Cultivated violets and wild pokeweed are important in furnishing opportunities for breeding early in the spring. The cowpea-pod weevil not infrequently attacks cotton.

EXAMPLES OF SIMPLE MEANS OF REDUCING INSECT INJURY BY MODIFICATIONS OF ROTATION SYSTEMS.

A few years ago Prof. H. A. Morgan [1] called attention to a practice followed in Tennessee which contributed greatly to damage by the army worm, *Heliophila unipuncta.* A common rotation in Tennessee and neighboring States is corn, wheat, and meadow. Generally after the corn is laid by, a heavy growth of weeds springs up. When the wheat is cut the second year there is a heavy growth of weeds from the seeds of the preceding season. These weeds are cut and left as a mulch for the meadow. They furnish protection for the army worm during the winter and spring of the third season. The consequence is the frequent destruction of the meadow crop and the spread of the insects into adjoining fields. In this case the difficulty would be largely, if not entirely, obviated by the addition of a leguminous crop, such as cowpeas, with the corn planted during the first season of the rotation. This would prevent the growth of weeds and there would consequently be no seed, or at least very little, to give rise to a growth of weeds after the wheat was harvested during the second year of the rotation.

It is a general practice among rice planters in Louisiana and Texas to allow the fields to lie fallow every third or fourth year to destroy red rice and other weeds. This practice has an important effect upon two of the insect pests of the rice crop, namely, the rice-root weevil and the grass worm. During the fallow seasons the rice weevils breed unrestrictedly on grasses, and are therefore present in numbers to attack the rice during the season it is planted. This form of injury is of most frequent occurrence where the rice lands

[1] Journal of Economic Entomology, vol. 1, p. 14.

are not fully drained during the fallow season. In the case of the grass worm, on the other hand, the injury is greatest on lands where the drainage is good. Under such conditions, during the fallow seasons, the grass worm breeds in great numbers. In fact, if it were not given this opportunity for breeding it is doubtful whether it would be an important pest of the rice crop. Obviously the best plan to follow would be not to allow the land to remain fallow. The only object the planter has in fallowing is to exterminate certain weeds. This could be accomplished exactly as well if the fields were planted in cotton, or in cowpeas or some other leguminous crop. The latter would be greatly preferable on account of the manurial effects of the legumes.

In Virginia and several neighboring States the tobacco crambid (*Crambus caliginosellus* Clem.) is one of the most serious insect pests with which the tobacco planters have to contend. The same species also attacks corn and frequently does great damage to the crop. The attack against tobacco, however, is more important. The injury does not become apparent until some time after the plants have been set in the field. Frequently this insect destroys numbers of the plants. This is likely to happen so late in the season that replanting is impracticable, and as a consequence a poor stand is obtained. As has been shown by Mr. E. H. Mathewson, of the Bureau of Plant Industry, success in producing tobacco depends largely upon obtaining a good stand. Hence the insect is one of the more important obstacles in producing tobacco profitably. The species breeds naturally in certain wild plants, especially the so-called ironweed or stickweed. This plant springs up in great profusion in fallow fields and the seeds are frequently found among clover seed. As a result, in the sun-cured tobacco region of Virginia there is a great abundance of stickweed plants, due either to adventitious growth or unintentional planting along with the seed. The weeds in the meadows are of special importance, for the reason that the general system of rotation in the tobacco districts of Virginia is to cause tobacco to follow two years of grass.

Through the circumstances mentioned the wireworms which were distributed on a large number of plants become concentrated upon a comparatively small number of plants, such as corn and tobacco. Naturally, rotation can assist greatly in the control of this insect. Tobacco or corn should not follow land that has been fallowed or grassland in which the ironweed has sprung up in abundance. In either case it is entirely feasible for the planter to precede tobacco with a crop of cowpeas. This has been found by Mr. Mathewson greatly to favor the growth of the tobacco in addition to practically eliminating the wireworms from the soil.

The southern corn rootworm, or drill worm, is partial to cereals. Where this insect is an important pest it is not wise to follow small grains with corn. Cotton, or better, solid cowpeas, soy beans, or velvet beans, would be much preferable as a crop to follow grain.

In several of the eastern Atlantic States the cotton is considerably injured by the root aphis. The primary food plant for this insect is corn. The injury to cotton by the root aphis generally does not become evident until the plants are rather well advanced. This makes it generally impracticable to counteract the injury by replanting. The greatest damage observed to cotton has been in fields where this crop has been planted after the land has been in corn for several seasons. Here the interposing of some crop like cowpeas immediately before the corn land is planted in cotton would not only deprive the insects of food and greatly reduce the numbers but would add to the fertility of the soil and increase the production of cotton during the following season.

By far the most important insect enemy of sugar cane in the United States is the borer *Diatræa saccharalis*. In Louisiana this insect lives indiscriminately on corn and sugar cane. The corn makes a much earlier growth than the cane in the spring. The borers therefore begin to breed in the corn before the cane is well started, and several generations are produced before the injury to the cane begins. It is evident, of course, that the greatest injury to sugar cane takes place where there is the greatest amount of early corn in the immediate vicinity or where sugar cane follows a crop of corn. The trouble would be corrected largely if the corn were to be planted some distance from the cane or by having spring-planted cane follow fields of solid cowpeas rather than corn or corn and cowpeas mixed.

The cotton aphis, as has been indicated, feeds upon melons and a variety of similar plants. In certain seasons when the climatic conditions are favorable to its development and its insect enemies are not abundant great damage is done to the cotton. Frequently one or more replantings are necessary. This is of special importance in regions infested by the boll weevil where replanting will prevent the obtaining of an early crop. In this case the proper procedure would be to plant legumes between the time the land has been occupied by melons and the time it is planted in cotton. It is also evident that melons should not be planted on land which has just been occupied by cotton. Where there is a rotation with melons and cotton the cotton should be preceded and followed by legumes, corn, or cereals.

The garden webworm does not attack corn, but the conditions in cornfields frequently allow the insect to breed in great numbers. The favorite food plants of the webworm are the species of Amaranthus known as "careless weeds" in the South. When corn is laid by these weeds sometimes grow up luxuriantly. The webworms increase correspondingly and are likely to damage cotton or truck crops planted subsequently. In fact, the injury of the webworm to cotton, which is more or less general throughout the South and of great importance in some seasons, has been traced to the excessive abundance of "careless weeds" during the preceding season. The planting of cowpeas with the corn would correct the difficulty in many cases, but of course there would still be an inflow from untilled fields, turn rows, and similar situations.

The corn and cotton wireworm damages a large number of plants, including tobacco, oats, rye, cowpeas, and peanuts. However, the injury to cereals is much less than to corn or cotton. Moreover, it has been found by careful field observations that extensive injury by the wireworm occurs only where the soil has been greatly depleted in humus. These two facts give a clear indication of a rotation system that should be followed. This is to devote lands subject to injury to oats or rye, which are to be removed sufficiently early in the season to allow the planting of cowpeas to be turned under to increase the amount of organic matter in the soil. After two seasons of this double planting there would be greatly reduced injury to subsequent crops of corn or cotton.

One of the most interesting instances of the value of a rotation is in the case of the boll weevil. This insect, as is well known, feeds upon no plant but cotton and has well-developed powers of flight. It is therefore not apparent at first sight how any special exemption from injury could be brought about by rotation. However, the weevil hibernates in great numbers in the fields where cotton has been grown and in their immediate vicinity. In the spring there is a series of flights in search of food, but these are weak and not at all to be compared with the strong dispersion movement of the summer and fall. During the spring many of the weevils perish if they do not find food within a short time. Very few reach cotton that is far removed from the place where hibernation took place. It has frequently been observed that cotton fields following corn show considerably less infestation than fields in which cotton follows cotton. This is more noticeably the case early in the season and sometimes gives the planter an advantage at a season when it is most needed. Although strictly a minor means of averting injury by the boll weevil, rotation is to be considered in connection with the more important means recommended by the Bureau of Entomology.

EXAMPLES OF ROTATION SYSTEMS CALCULATED TO REDUCE INSECT INJURY.

The Georgia Agricultural Experiment Station recommends, as a general scheme of rotation in that State, corn and peas, oats and peas, cotton. For thin land the station recommends that this rotation be extended to four years by repeating the oats and peas for one additional season. In either case this scheme is an excellent one from the standpoint of insect control. It is much better to have the oats follow the corn rather than cotton. If the cotton were to follow the corn directly it would suffer materially from root-aphis injury in many situations in Georgia.

The North Carolina Experiment Station recommends an equally judicious three-year rotation for use in that State. This consists of cotton, corn and peas, wheat and peas. In this case the wheat and peas are interposed between corn and cotton, and this will have the effect of reducing injury by the wireworm to the latter crop.

Several years ago Prof. W. C. Stubbs recommended a rotation for use in Louisiana which increased the fertility of the land by from 12 to 25 per cent. In this rotation corn was followed by oats and cowpeas and these followed by cotton. The only danger in this system is from the cowpea-pod weevil that might breed upon the peas during the second year to damage the cotton during the third year. However, this injury is never very severe and is not sufficient to outweigh the other decided advantages of the system. Mr. W. A. Orton, in Farmers' Bulletin 302, recommends a very satisfactory system of rotation for use with Sea Island cotton. It covers three years and consists of rye, oats, or wheat and peas for the first season, corn and Iron cowpeas for the second year, and cotton for the third. This would reduce the insect injury to a very low degree. Mr. C. W. Warburton, in Farmers' Bulletin 424, recommends a system for rotating cotton and oats. It consists of corn and cowpeas for the first year, oats and cowpeas for the second, and cotton for the third. There is the same minor objection that applies to the Louisiana rotation to which reference has just been made, but this is not of very great importance. A good system of rotation for tobacco in Virginia has been proposed by Mr. E. H. Mathewson. (See Yearbook of the Department of Agriculture for 1908, p. 403.) This system covers six years, as follows: Tobacco, one year; wheat, one year; grass, two years; corn and crimson clover, one year; cowpeas, planted alone, or wheat or corn and cowpeas, one year. This rotation would have the effect of practically eliminating wireworm injury to tobacco, although the corn crop after two seasons of grass might suffer. For this reason it would appear to be desirable to change the places of the crops mentioned for the fifth and sixth years.

RECOMMENDATIONS.

The following are some of the general recommendations that become evident from even a cursory study of the subject of insect injury in connection with crop rotations:

(1) Short, rapid rotations are better than prolonged ones. For example, corn planted continuously each season becomes more and

more infested by the root-aphis. Cotton after one year of corn is much less subject to attack than after several seasons in corn.

(2) The practice of fallowing lands is objectionable, for the reason that it allows certain insects to multiply in great numbers. Of course there are also broad agricultural objections to fallowing, and the practice is rapidly becoming obsolete in the South. In some localities it may be necessary to continue it for a number of years. Wherever it is necessary for any reason the land should be plowed during the fallow season to destroy the vegetation, or at least the weed growth should be kept down by mowing.

(3) The destruction of the remains of the crop should be practiced generally. In many instances this will prevent spread of the insects to adjoining fields.

(4) In general, pastures should be followed by broadcast crops. Where a crop which has comparatively few plants to the acre follows a pasture there is danger that the insects which feed upon the grasses will become concentrated upon the comparatively few plants of the following crop. In case a broadcast crop follows the pasture, however, the injury is distributed over a greater area and becomes much less important.

(5) From the standpoint of insect injury cotton is a safe crop to precede any other grown in the South except melons and, under some conditions, corn. This fortunate circumstance favors the successful beginning of a rotation anywhere that it becomes necessary or advisable. One of the exceptions in which it is inadvisable for corn to follow cotton is where the latter crop has been seriously injured by the bollworm. However, all danger can be eliminated by fall or winter plowing after the cotton is picked. Wherever possible the cotton fields should be planted with clover or vetches before the stalks are removed. This practice is greatly favored by the fact that where the boll weevil exists it is absolutely necessary to procure an early crop. Heretofore the main reason for not utilizing cotton in a rotation in which another crop is planted during the same season has been that a long time is required to mature and harvest the crop. Under the changed conditions recently brought about the cotton crop must be made and harvested so early that there will be ample time for the planting of any suitable fall or winter crop.

(6) Cowpeas should invariably be planted with corn. This will prevent the growth of weeds which support the garden webworm, grass worm, and other species, which, otherwise, would injure the crop that follows the corn.

(7) A succession of crops of the same botanical family should be avoided. The obvious reason for this recommendation is that insect pests are more likely to injure plants of the same botanical family than unrelated ones.

(8) Very fortunately it appears that the legumes cultivated in the South are not greatly subject to insect attack. There is one exception, which, however, is of not very great importance. This is the cowpea-pod weevil, which sometimes attacks cotton following cowpeas. In one respect, however, cowpeas are dangerous. That is because they are attacked by nematode worms which later in the rotation may attack cotton, tobacco, and numerous other crops. Under these circumstances it is gratifying that the Bureau of Plant Industry of this department has perfected a variety known as the Iron cowpea which is resistant to the nematode disease. Wherever nematodes are abundant this variety should invariably be planted.

THE WEATHER BUREAU AND THE CRANBERRY INDUSTRY.

By HENRY J. COX,
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INTRODUCTION.

In this country the cranberry is indigenous to the marshes, chiefly in the Northern States; but some wild cranberries are found as far south as North Carolina, both in the swamps of the mountain region in the northwestern portion of that State and near the coast, in Pender County. They are also found to a slight extent in some portions of northern Europe, especially in Finland and the Scandinavian Peninsula. However, the cultivation of the cranberry has been confined to this country, and almost entirely to the States of Massachusetts, New Jersey, and Wisconsin. In Massachusetts the cultivation is not limited to Cape Cod, as many suppose, but the fruit is grown extensively also in Plymouth County, in portions of Bristol County, and on the islands of Marthas Vineyard and Nantucket. The Burgess bog in Nantucket, with 250 acres of planted vines, is the largest in existence. In New Jersey cultivated cranberries are raised in Cape May, Atlantic, Gloucester, Burlington, Ocean, and Monmouth Counties; in Wisconsin, in Wood, Jackson, Juneau, and Monroe Counties in the Wisconsin River Valley, and in Waushara and Winnebago Counties in the Fox River Valley. Moreover, cultivation is practiced to some extent in northern Wisconsin near Lake Superior, and to a less extent in Michigan and Minnesota. Massachusetts, New Jersey, and Wisconsin produce, on an average, 300,000, 150,000, and 75,000 barrels, respectively. It is only in these three States that berries are grown for commercial purposes, the wild marshes in other sections producing barely enough fruit for local consumption.

CULTIVATING, SANDING, AND DRAINING.

In cultivating, nothing is done other than weeding and sanding, and the peat bogs are sanded mainly for the purpose of keeping down the rank growth of vegetation; but while sanding is practiced in Massachusetts, only a small percentage of the bogs in New Jersey and Wisconsin are sanded. New Jersey growers believe that vines growing in an unsanded peat bog produce better fruit than where sanding is practiced, while the Wisconsin growers claim that they are unable readily to secure a gravelly sand, such as is successfully used in Massachusetts, and they feel that the expense of putting on sand is not justified by increased returns. However, as a result of the higher cultivation, a crop in Massachusetts averages about 40 barrels an acre, while in New Jersey and Wisconsin the average is 25 and 20 barrels, respectively. Under the most favorable conditions in Massachusetts, 200 barrels have been gathered from a single acre. In sanded bogs a layer of sand about 3 inches in thickness is spread over the peat before the vines are planted, and later, every 2 or 3 years, a layer of half an inch is spread over the bog.

A sanded and cultivated bog is much less liable to frost than is a bog with plain peat and dense vegetation, because sand is a good conductor of heat, and a clean surface permits the sun's rays to heat the soil in the daytime. Moreover, where the marsh is well drained, frost is not as likely to occur as in a wet marsh, where the temperature is lowered considerably through the process of evaporation. Sanding, cultivating, and draining, therefore, tend to prevent night minimum temperatures from sinking to a low point. There is a great difference in the temperature conditions in various bogs and even in portions of the same bog, and damage often occurs in various sections of an individual marsh, while the other parts, more favorably situated, are not affected. It is because of these extraordinary circumstances that meteorologists have been especially interested in the temperature and frost conditions in the cranberry marshes; and because ordinarily, during cool, clear nights, frost is most likely to occur in these bottom lands where the cranberry grows, the cold, heavy air above settling through gravity to lower levels near the ground when the wind is light.

TOPOGRAPHY OF MOORLAND SECTIONS.

The cranberry marshes in Wisconsin, especially those in the Wisconsin River Valley, are located in extensive moorlands that reach for miles and miles, with here and there occasional islands, usually not more than 5 or 10 feet in elevation. (See Pls. VI and VII.) The New Jersey cranberry region is flat, like that in Wisconsin, while the Massachusetts section differs much from these two, the configuration of the ground in Massachusetts being well broken and the bogs small, usually not exceeding a few acres each, and surrounded by uplands often from 30 to 50 feet in height. As a rule, the cranberry growers there include in their properties several small bogs joined together by ditches for the purpose of irrigation and flooding.

TEMPERATURE CONDITIONS AND RESERVOIRS FOR FROST PROTECTION.

The temperature conditions are much more severe in Wisconsin than in Massachusetts and New Jersey, the minimum temperatures during the growing season averaging in Wisconsin 5° lower than in

Massachusetts and 8° lower than in New Jersey. Frost is liable to occur in any month of the year in Wisconsin, while midsummer frosts are unknown in the East, and consequently the growing seasons in Cape Cod and New Jersey are much longer than in Wisconsin. It is only during a year in which the crop season has a temperature far above the normal that the cranberry grower in Wisconsin, without means of protection from frost, can hope to gather even a fair crop. Many growers, especially in Wisconsin, have provided reservoirs in which water is stored for the purpose of flowing the marsh in anticipation of frost. (See Pl. VIII and Pl. IX, fig. 1.) In fact, the first thought of the Wisconsin grower generally is to provide ample water supply. In some of the reservoirs the water is held in canals similar to that shown in Plate VIII, figure 1, and when needed the dam is lowered as shown in Plate VIII, figure 2. In other cases the water is held in floating marshes as in Plate IX, figure 1, and is connected by ditches with the cultivated bogs lower down. Sometimes, especially in Massachusetts, the flowing of a bog does not depend upon gravity, but the water is pumped from a pond or river. Some growers are able successfully to flow their marshes in about four hours, but this can not be done unless the water in the ditches is above the usual height. When gravity is not the motive power rapid flowing can not be done in anticipation of frost. When available, water is used for flooding the bogs during the winter time in order to prevent winterkilling, the covering usually being left on the bog from some time in November until the following spring. When a marsh is habitually wet, its temperature, owing to the evaporation of moisture, is much lower than that in a dry bog. But the water in the reservoir is comparatively warm, and sometimes the cranberry grower is able to avoid injury from light frost by simply raising the water in the ditches; at other times, when the frost is more severe, by barely covering the surface of the marsh; while during a severe freeze it is necessary to cover the bog completely.

SPECIAL INVESTIGATION INTO FROST AND TEMPERATURE CONDITIONS IN CRANBERRY MARSHES.

It should be apparent from the foregoing that success in the cranberry industry depends to a large extent upon accurate frost warnings by the Weather Bureau. Several years ago three stations were established in the cranberry marshes of Wisconsin and observations reported by wire to the forecast center at Chicago daily. In 1906 an exhaustive investigation was inaugurated at selected marshes at Berlin and Mather, and continued during the season of 1907, and the observations at these places were supplemented by data furnished by the Wisconsin branch experiment station at Cranmoor. The telegraphic reports from the three places have been continued up to the present time and form a permanent feature of the Weather Bureau work, the results of the special investigation having been published in Bulletin T of the Weather Bureau, "Frost and Temperature Conditions in the Cranberry Marshes of Wisconsin." Moreover, a cranberry-marsh station has been maintained for several years in the bog of Mr. J. J. White, near New Lisbon, N. J.; and more recently similar stations have been established in Massachusetts at South Carver, Halifax, Marstons Mills, and the State bog in East Wareham, some special work at East Wareham now being conducted by the Weather Bureau in cooperation with the Massachusetts experiment station.

As stated above, the minimum temperature in the bogs on cool, clear nights falls to a much lower point than in the surrounding region; in fact, so low in Wisconsin that even in midsummer great injury often results to the crop unless the grower has means of protection in the shape of ample water supply. An instance of these extraordinary conditions was noted on the morning of August 8, 1904, some time before the investigation was commenced, when the minimum temperatures at Mather and Cranmoor, Wis., were 29° and 26°, respectively, and severe frosts were general throughout the moorlands. This frost caused great damage not only to the crop of 1904 by freezing the berries, but also to the crop of 1905 by freezing the terminal buds. Often during such unusual conditions the readings of thermometers at the regular Weather Bureau stations furnish no indication of frost in the bogs; and on the date in question the minimum thermometer in a shelter at La Crosse, Wis., about 55 miles west of the cranberry region, registered 48°, or 22° higher than in the open on the bog at Cranmoor and 19° higher than at Mather. For an entire season there was found to be an average difference on all nights of 11.9° between the minimums at Mather and La Crosse; on cool, clear nights the difference was always much greater, 20° to 24°, but the difference was very slight on cloudy nights.

At Mather and Berlin, Wis., in connection with this special investigation, a number of stations were established in two selected bogs in order to secure exact data. For purposes of comparison, observations were made on the adjoining uplands as well as on the bogs, and thermometers were placed at each station inside a shelter as well as in the open. At these various stations maximum, minimum, and soil thermometers and soil thermographs were installed, and this equipment was supplemented by additional instruments at some stations where special comparisons were desired. Plate IX, figure 2, shows one of the stations at Mather. The station on the upland was over sod, and a station was placed at the main reservoir. (See Pl. IX, fig. 1.) The stations in the cultivated marsh are described as follows: (1) A newly sanded and thinly vined section;

(2) a newly sanded and heavily vined section; (3) an old sanded and heavily vined section; (4) an unsanded bog, heavily vined and with moss. Outside the cultivated bog were placed two additional stations, one over sphagnum moss and the other in a small scalped area. An anemometer was placed on the top of the warehouse about 50 feet above the marsh in order to provide a means of comparison with the wind movement on the bog. At Berlin the equipment was not so extensive and the observations were made rather to supplement those at Mather. The important features in the observations will be summarized as briefly as possible, as space does not permit an extended discussion.

The minimum temperatures in the open averaged for the season of 1907 2.8° below those in shelters; the greatest difference at any one station occurred in the midst of a heavily vined section, the average being 3.7°, while at the station among the thin vines the average difference was but 2.5°. There was very little difference on cloudy or windy nights, but on cool, clear nights with little or no wind, the differences were great, the greatest being 9.9°. The least differences usually occurred during the month of May, with an irregular increase toward midsummer, and then a falling off which was later followed by another maximum in October, when radiation was greater because of the longer nights. The readings of the instruments in the shelters indicate the true temperature of the air at the various stations, while those in the open, strictly speaking, represent the temperature of the instruments themselves, but they may be considered to indicate approximately the temperature of the vines or plants. It is probable that the temperature of the vegetation was even lower than that indicated by these thermometers. The differences, however, can not be great because the minimums in the open often registered as low as 28° without apparent damage to the vegetation.

A comparison of the minimum thermometers placed in the open at the surface of the ground and at the 5-inch height near the tops of the vines shows that an almost uniformly higher temperature prevails at the lower position. The readings were higher at the surface because of the heat conducted from the soil below and also because radiation was much freer at the higher elevation. The difference was greatest on cool, clear nights with high barometer and light wind, when radiation was freest, in many instances the difference exceeding 6°. The average difference at all stations for the season was 1°, while the average difference on clear nights was 4°.

The cranberry vines extend along the surface, their uprights, on which the fruit grows, reaching above several inches. On the best bogs in Wisconsin the height of the uprights is ordinarily not more than 5 inches, while in the poorer ones the height often reaches 10 or 12 inches. In Massachusetts, on the other hand, the uprights seldom exceed 5 inches and usually are considerably less. It is because of the supposed similarity of the upright to the neck of a crane that the fruit gets its name, *craneberry* or *cranberry*.

In a marsh, grasses and uprights from the vines interfere with the radiation of heat from the surface of the ground, and it is probable that a leaf or vine exposed at an elevation above the ground loses its heat more rapidly by radiation than one resting upon the surface, because the upper one is not shielded in any way, and while radiation is going on from the lower one, at the same time heat is being conducted to it from the ground beneath. A thermometer or vine resting upon the surface of the bog becomes, as it were, a part of the soil or vegetation upon which it rests and is affected by the conduction of heat to it from the ground, while the conduction to and through the air is very slow in comparison. As a consequence, cranberries at the tops of the uprights a few inches above the ground are often damaged by frost, while those lying on or near the ground, sheltered as they are from radiation, escape injury, as shown by personal observations of the writer. Frost was always first noticed on the upper surface of the wooden tracks over which cars laden with berries are pushed, and was not observed until later on the crossties lower down. One morning at Berlin the thermometers at the 5-inch height were found completely covered with frozen dewdrops, the dew having been deposited some time during the night, while the thermometers resting on the surface of the ground were absolutely free from frost or moisture of any kind. The upper thermometer registered 28.8° and the lower one 32.6°. This is a most striking example of safety at the surface and frost and possible destruction a few inches above the ground.

In a comparison between a number of minimum thermometers placed at various elevations above the surface up to 36 inches over the bog where the vegetation was dense, it was found that the temperature at the height of 5 inches again averaged the lowest, the mean minimum at that point being 40.1°, while the temperature gradually increased thence downward and upward, it being 41.8° at the surface and 43.2° at the 36-inch height. However, during the months of May and June, the temperature at the 2½-inch height averaged lower than at the 5-inch height. Moreover, in every month throughout the season the temperature was highest at 36 inches, with a secondary maximum at the surface.

While the minimum thermometers were usually the lowest at either 2½ inches or 5 inches above the surface, and the temperature averaged higher for each month and for the season at 36 inches than at the surface, yet on cool, clear night, when radiation was the freest,

TYPICAL CRANBERRY MARSH, CITY POINT, WIS., SHOWING UPLANDS ON EITHER SIDE.

FIG. 1.—CRANBERRY MARSH, CAMERON, WIS., SHOWING PICKERS AT WORK.

FIG. 2.—CRANBERRY MARSH, CRANMOOR, WIS., SHOWING PICKERS AT WORK.

FIG. 1.—CANAL USED AS RESERVOIR, CRANMOOR, WIS.

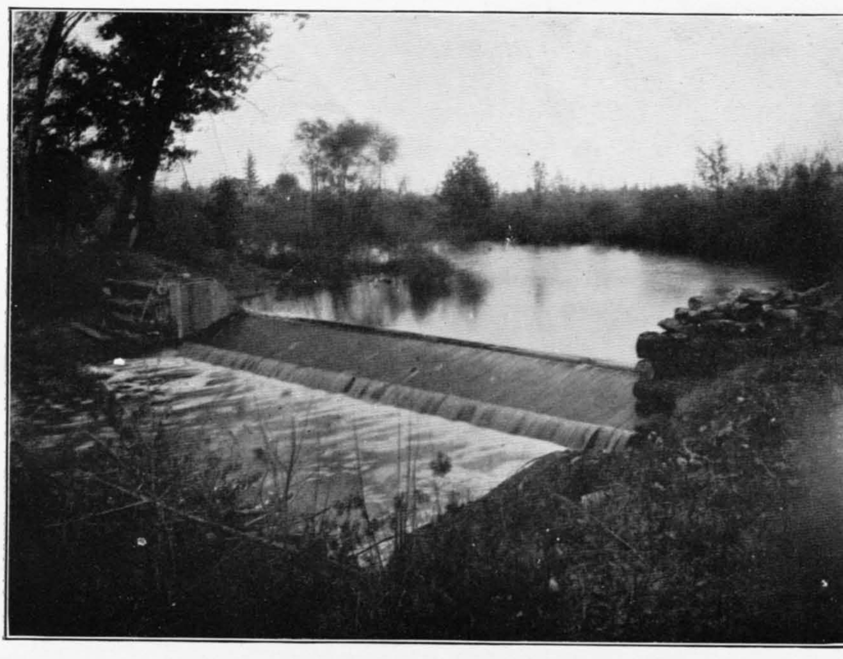

FIG. 2.—DAM SUPPLYING CRANMOOR MARSHES, CRANMOOR, WIS.

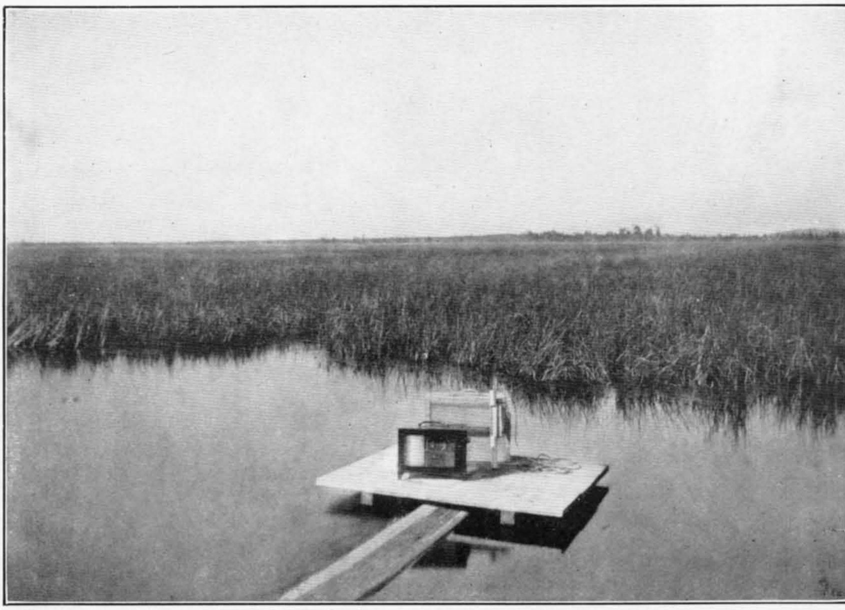

FIG. 1.—FLOATING BOG USED AS RESERVOIR, MATHER, WIS.

[Instruments in foreground for recording water temperature.]

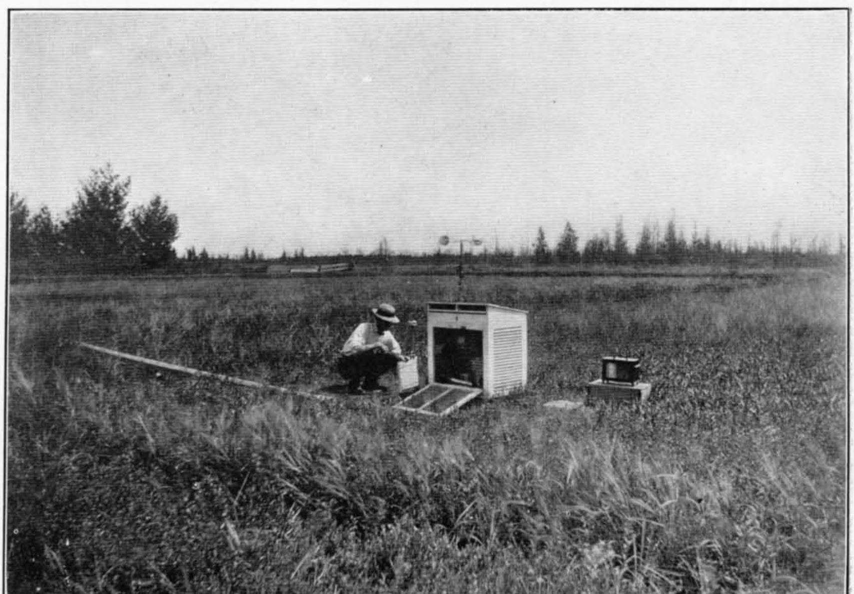

FIG. 2.—CRANBERRY MARSH, MATHER, WIS. SPECIAL OBSERVING STATION IN FOREGROUND.

[Instrument shelter in which thermometers are located; psychrometer attached to left of shelter; observer making an observation; anemometer on top of shelter, and soil thermograph to right.]

the exposed minimum at 36 inches usually registered lower than at the surface. Moreover, on the coolest nights the difference between the exposed minimum at the surface and the 5-inch height was the greatest, occasionally exceeding 6.0°, as in the month of October. On warm nights, however, almost without exception, the thermometer at 36 inches registered considerably higher than at the surface, the maximum difference (6.7°) occurring on a partly cloudy night.

Having seen how the temperature in the open differs from that in a shelter and how the temperature varies at different elevations, it will now be interesting to note what a great difference prevails between the readings of minimum thermometers at the various stations in the same bog. The coldest places in the bog were in a section that was unsanded, heavily vined, moist, and mossy, while the highest temperatures prevailed in a sanded, thinly vined, and well-drained section. Between these two extremes were intermediate values at stations where the soil was newly sanded and heavily vined and old sanded and heavily vined. The average minimum readings for the season in the open at 5 inches above the surface were as follows: Newly sanded, thinly vined, and well drained, 43.8°; newly sanded and heavily vined, 43.2°; old sanded and heavily vined, 41.2°; peat bog with moss, heavily vined and poorly drained, 40.1°. A close relation was found to exist between the various minimum readings on the one hand and the maximum soil temperatures and the daily variation in soil temperature on the other. In other words, at places where the soil was heated most during the day in the thinly vined, well-drained, and sanded section, there were found the highest minimums, while in the moss-covered peat bog with poor drainage, where the soil was but slightly heated during the day, the lowest minimums were found. Sand is a good conductor of heat, while peat, being porous, is a poor conductor, so that sanded sections, even though they may be heavily vined, are heated more in the daytime than unsanded sections. The old sanded section referred to above is a portion of the marsh that had been sanded about eight years before, a layer of peat having since formed over the sand about an inch in thickness. During the day the surface of the earth upon which the sun shines becomes hotter than the air above it, and the readings of the instrument resting on the ground indicate relatively high or low maximum temperatures in the daytime and relatively high or low minimum temperatures at night, depending upon the radiation, absorption, and conduction of heat under the various conditions. The vegetation as found in the bogs is an excellent radiator and absorbs well, but, of course, conducts and transmits heat to the soil very slowly. The heat lost from vegetation is largely by radiation through the air without heating it sensibly. Peat soil is also a good radiator and absorber, though a poor conductor, but the heat received at the surface is partly conducted into the peat. The sanded surface is not as good an absorber, but it is a much better conductor of heat. The heat, moreover, of sand in the presence of air is lost largely by conduction to it, and consequently serves to heat the air lying immediately above—in strong contrast to the conditions over a heavily vined surface or plain peat, where the loss is mainly by radiation.

The daily readings of the minimum thermometers were almost invariably higher in the sanded and thinly vined section than in the unsanded section, with the exception of the month of October, an inversion of the usual conditions occurring on 10 days during that month. This changed relation was undoubtedly due to the fact that frost had entered the sanded soil as well as the peat soil, and it is probable that when frost is in the soil its character, whether it be peat or sand, is of little consequence in affecting night temperatures.

The minimums in the open at the surface of the thinly vined, sanded, and well-drained section were of course the highest observed on the bog, while the lowest were over the uncultivated peat bog with moss, heavily vined and poorly drained at the height of 5 inches. While the difference between the surface thermometers was great, the difference between the surface minimum at the warmest place and the minimum at the 5-inch height at the coldest place was still greater, the average seasonal difference being 4.4°, the greatest average monthly difference, 7°, being in June and the least monthly difference, 3.2°, in May. There were but five instances throughout the season that the daily minimum at the surface of the warmest section was lower than the upper minimum at the coldest section.

Moreover, the minimum temperature in the open at the coldest place averaged for the season 6.7° lower than in the shelter on the upland, and the daily differences were often much greater, the maximum departure being 14.6°, while the average departure in the month of October, when the nights were becoming long and cold, was 8.3°. In the warm, thinly vined section the average for the season was only 1.3° lower than in the shelter on the upland, and in the summer months the average was less than 0.2°, the temperature here on the bog often being higher. The greatest departure was in the spring and fall, especially in October, when the average was 4.5°.

From observations made in the Berlin bog, it was found that in a sanded section, 100 feet square, in the midst of a peat bog where other conditions as regards moisture and vegetation were practically identical, the influence of sanding was almost lost at an elevation of 3 feet; and a comparison made between two sanded and thinly vined sections in the same bog, one wet and the other dry, demonstrates the advantage of keeping a bog dry and as far as practicable free from a moisture-laden evaporating surface, the minimum temperature over the dry section averaging for a month 2.4° higher than that in the wet section, the difference reaching on some nights 7° or 8°.

RELATION BETWEEN DEW POINT AND MINIMUM TEMPERATURE.

A dry atmosphere permits freer radiation of heat from the ground than moist air. Moist air absorbs part of the heat radiated from the ground, and consequently does not permit as low temperatures as when the air is dry. The marsh region of Wisconsin, however, is almost always humid at night, but remarkably low temperatures, nevertheless, occur in spite of these humid conditions. It may be that under such conditions the air at some little distance above the bog is relatively dry and permits rapid radiation through it. It has long been supposed that a relation exists between the dew point and the ensuing minimum air temperature, and that, if the dew point at the time of observation in the evening was higher than 32°, frost should not be expected that night. It was believed that, the dew point having been reached, latent heat would be given off in the operation of condensation and thus prevent any further fall in temperature. This is a plausible theory, and many cranberry growers have confidence in it, but the observations made on the bogs show that the dew point itself is no indication whatever of the ensuing minimum temperature, as it averaged from 7° to 8° higher than the minimum, the difference on some nights being as much as 20° to 25°.

Naturally, if the air were drier the temperature would fall to a lower point; but the air is usually humid in the bogs, as stated above. The vapor in the air is so great that ordinarily on cool, clear nights dew forms even at sunset. In spite of the fact that the air may be saturated with moisture, the temperature frequently continues to fall steadily through the night, demonstrating that the latent heat given off in condensation has but little effect in retarding the fall in temperature. The thermograph traces of the instruments exposed in the open often show a steady decline in temperature on nights of dew and fog when the sky is clear.

EFFECT OF FROST ON THE CRANBERRY.

The berry when green can usually withstand a temperature in the open of about 28°, and when fully matured, about 22°, depending, of course, upon the duration of the critical temperature. The resisting power of the cranberry increases steadily as it matures. As it ripens, it not only colors, but the skin thickens, and its content changes somewhat, offering an increased resistance to frost. Berries exposed to frost on two successive nights after apparently having escaped injury the first night, will on the morning following the second night exhibit symptoms of being frozen, even though the cold on the second night is not as severe as on the first. The low temperature of the first night starts in the berry a certain disintegration which is completed during the second night.

TEMPERATURE IN WIDELY SEPARATED BOGS.

In this paper, thus far, reference has been confined almost entirely to comparisons between observations made in a single bog. There are times when the weather remains or becomes cloudy in one section of the Wisconsin marshes with attendant high temperature, while clear and cool weather prevails in another. There are also considerable differences when areas of high and low pressure are moving rapidly across the north-central States, so that the distance of 80 miles, the extreme limit of these bogs from west to east, is of much importance. While the average minimums for the season of 1906 over peat bogs at Cranmoor, Mather, and Berlin, Wis., show but little difference, being respectively 47.9°, 48.6°, and 47.9°, there were often large differences on single days, 7° or 8°, but rarely more than 10°.

In Massachusetts the bogs are all well sanded, and the character of the vegetation does not vary greatly, most of the bogs being well cultivated. The bogs differ because of their geographical location; that is, being situated at varying distances from the sea, and because of the marked variation in topography. As has been stated before, prominent uplands usually surround the Massachusetts bogs, and some of these bogs are in what might be termed "sinks." The cold air drains down the slopes and settles over such marshes, while in others a natural outlet exists, so that the air as it drains over the bog passes beyond, the air of different strata being mixed together, thus preventing the temperature at the surface from falling to as low a point as when the air is confined. In many of the bogs, moreover, there are pockets where the movement of the air is not free and, as a consequence, the temperature is lower than out in the open. Again, the bogs in Massachusetts are located at varying distances from the sea, which controls the temperature to a marked extent, especially in the autumn. The conditions in Massachusetts are, therefore, quite complicated. As compared with East Wareham, the average minimum temperature for the season of 1911 was lower at South Carver by 3.5°, at Marstons Mills by 3°, and at Halifax by 3.4°. The temperatures were usually higher at East Wareham than at the other bogs, because East Wareham is located close to the sea, and the differences were least in spring when the water is relatively cold, and more marked in late summer and autumn after the summer's heat. Of course, the influence of the sea is of little consequence unless the wind at the time is blowing from that direction over the land. While the season in Massachusetts is ordinarily much longer than that in Wisconsin, killing frost ordinarily not occurring until two or three weeks later, severe frosts visited the Massachusetts bogs in the middle of September, 1911—much earlier than in Wisconsin. The minimum temperatures in the open in the Massachusetts bogs during this period were as follows:

Station.	Sept. 13.	Sept. 14.	Sept. 15.
	° F.	° F.	° F.
East Wareham	37	32	35
South Carver	33	25	25
Marstons Mills	41	32	31
Halifax	32	22	26

On the days in question the minimum temperatures in the shelter at the Boston weather office were, respectively, 48°, 40°, and 48°. The extreme differences between these temperatures and the minimums at South Carver and Halifax were approximately the same during critical nights as those between La Crosse, Wis., and on the bog at Mather.

CONCLUSION.

Frost occurs only under the influence of a cold high area, and while in Wisconsin it may occur in any month of the year, it almost never occurs during the summer months in the eastern cranberry bogs. Critical temperatures occur in Wisconsin when the high moves southeastward from the British Northwest over that State, or when the high moves directly eastward with its center covering the Lake Superior region, causing light northerly winds over the sections to the south. It is the latter high that may sweep across the northern tier of States and produce additional damage in Massachusetts, or occasionally an area of high pressure may move from the Hudson Bay region southeastward, bringing damaging frosts to New England, as in September, 1911.

While frost is most likely to occur on a night following a cloudy, windy day with wind falling and sky clearing at sunset, it is even more likely if there has recently been a light rain, the evaporation of moisture from the surface of the bog by the wind adding to the ensuing cold. During the growing season it is seldom that frost occurs when the pressure reduced to sea level is less than 30.2 inches, and experience in Wisconsin has shown that frosts seldom occur in the summer on a night following a day when the maximum temperature in the shade is higher than 70°. If a maximum of more than 70° has been reached, it is quite certain that the temperature of the soil is sufficiently high to prevent the occurrence of frost, but if the previous day has been cloudy, the storing of heat in the soil has been interrupted, and the point of critical temperature, therefore, will be more readily reached. The relation between the temperature of the soil and the occurrence of frost is noticeable in that it is practically impossible for frost to occur in the bogs on the first cool night following a warm spell, but it is more likely, if conditions are favorable, on the second night after the soil has become cold. The temperature of the soil tends gradually to increase until after midsummer, and then gradually decrease again. The soil being cold in the spring and early summer, and again in the fall, frost is more probable then, regardless of the accompanying conditions of atmospheric temperature and pressure. That is, the ground being cold, frost will occur in the marshes in May and early in June under the influence of areas of high pressure and accompanying low temperatures that would be far from sufficient to cause frost during the midsummer months after heat has been stored up in the soil. The length of the nights is also very important in estimating the probability of the occurrence of frost, especially during the months of September and October, as the nights steadily grow longer and afford greater opportunity for radiation without compensating insolation.

The work of forecasting frost for the cranberry marshes is important and requires constant vigilance. Many growers wish to be advised when frost is *possible* as well as *probable*. Of course, there are certain times when the question of ensuing frost is doubtful, one or two degrees higher or lower being sufficient to prevent or produce frost; or the occurrence of frost and possible injury frequently depend upon the length of time the temperature remains at the critical point, and the question of a few minutes one way or the other may be sufficient seriously to affect the entire cranberry crop. The chief purpose of the forecaster is to advise growers of all serious frosts, because it is not sufficient to save the crop from one or two frosts and allow it to be injured later, but the work should be carried on to the end of the season, to a successful conclusion. Great care, however, must be exercised in issuing warnings, so that the grower may not use up his water supply unnecessarily; because, if the season is dry and the water low, and he makes too liberal a use of it, means of reflowing may not be at hand later when great danger threatens. In view of the fact that reflowing should not be resorted to any oftener than is absolutely necessary, the forecaster and the grower have between them a problem that is always interesting and sometimes very difficult. The results of the investigation in Wisconsin have proved of great advantage to the growers, and it is probable that the work now being conducted in the Massachusetts bogs will bear immediate fruit.

IMPORTANT AMERICAN SOILS.

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CHARACTER AND ORIGIN OF SOIL TYPES.

While the agricultural domain of the United States comprises a great variety of diverse soils, there are certain definite types which dominate the regions within which they occur, both because of their areal extent and because of their special adaptation to the production of the most important staple crops.

The great grain-producing section of the North Central States has developed as such because the climate was congenial to the growth of the staple grains, because the soil was adapted to their production, and because the surface configuration of the region was such that large areas might be brought under cultivation with little waste land due to steep slope or irregularities of land surface.

This region, comprising southern Michigan, central and western Ohio, northern Indiana and Illinois, southern Wisconsin and Minnesota, the eastern portions of the Dakotas, Nebraska, and Kansas, and all of Iowa, with the portion of Missouri north of the Missouri River, is marked by the widespread distribution of a few soil types and by those peculiarities of climate and of surface topography which are favorable to the production of corn, wheat, oats, barley, hay, and flax.

While there are differences of precipitation within this territory which modify the classes of crops to be grown, and though the length of growing season varies so widely that corn dominates one portion and spring wheat another, yet the rainfall is sufficient in any ordinary year for the maturing of the usual farm crops, and the farmer is assured of a sufficient period free from frost to permit of the production of one or more of the great staple crops. Even with these advantages of climate there might exist a sandy waste or a rock-strewn mountain mass except for those forces which have formed the soils of the region and prepared them for an agricultural occupation as complete and as profitable as may be found over any large extent of territory upon the earth. This region is the great granary of the Nation, because the soils are fitted for grain production.

This entire area was invaded by a succession of glacial advances within recent geologic times, and the action of the ice tended to smooth over previously existing inequalities of the land surface, to fill the hollows and round the hills, and, most important of all, to leave deep deposits of complexly mingled soil materials which have given rise, either directly or indirectly, to some of the most fertile and lasting American soils. Coupled with this glacial modification of the Central States was a generous distribution of the same classes of material, reworked by the waters flowing from the melting ice and ponded in the great depressions of the present Lake region. These glacial lake deposits have also formed deep, fertile soils over considerable stretches of territory. Even the wind became an important agent in the formation of the soils of the Central States, in that it moved and redistributed the fine silty glacial sediment as a soft stone-free layer, covering the river banks for miles back upon the uplands, and even clothing the surface of a region measured by hundreds of thousands of square miles with the brown or yellow silt known as the loess. The soils of the Central States are derived from these classes of material.

SOILS OF THE CENTRAL STATES.

Four great soil types dominate the Central States. They are the Miami clay loam, found in central and western Ohio, eastern Indiana, and the extreme southern portion of Michigan; the Marshall silt loam, which is first encountered in west central Indiana and extends thence through central and northern Illinois, north central Missouri, southern Iowa, well into eastern Kansas and the eastern two-thirds of Nebraska; the Carrington loam, which dominates northern Iowa, southern Minnesota, and the eastern portions of the Dakotas, outside of the Red River Valley; and the Fargo clay loam, which constitutes the principal soil of the Red River Valley in eastern North Dakota and northwestern Minnesota.

THE MIAMI CLAY LOAM.

The Miami clay loam is the most important of the soils of the timbered region comprising the eastern portion of the Central States. It is most extensively developed in southern Michigan, western Ohio, and eastern Indiana, although small areas are found in Wisconsin and Iowa. A total area of 2,281,482 acres has been mapped by the soil survey, and it is probable that not less than 20,000,000 acres of the type exist in the region indicated.

The surface of the Miami clay loam is a rather heavy brown, yellow, or gray silty loam, having an average depth of 10 inches. This is underlain by a stiffer brown or yellow silty clay loam or heavy clay. Both are derived through the surface weathering of deep deposits of ice-laid material, consisting of mechanically ground-up and complex fragments derived from a variety of sources. The surface soil is usually fairly free from any large masses of rock or extensive accumulations of stone and gravel, although these are found in increasing quantities in the deeper subsoil and in the underlying till.

The bowlders, stone, and gravel comprise fragments of granite, gneiss, schist, quartzite, sandstone, shale, and limestone, and the finer earthy particles associated with them are of origin as diverse, insuring a fertile and lasting soil basis.

The Miami clay loam occupies nearly level to rolling or somewhat hilly areas, lying at altitudes ranging from 600 to 1,100 feet above tide level within the middle temperate zone of the Central States. The annual rainfall is abundant for all purposes of crop production.

The greater proportion of the type is naturally well drained, though the installation of tile underdrains has improved the crop-producing capacity of the soil upon all of the more level areas.

The Miami clay loam ranks as a general farming soil. No one crop has attained preeminence of production upon the type. The acreage devoted to corn slightly exceeds that sown to winter wheat, and these constitute the grain crops of most general production. The oat crop is also important. The area annually devoted to hay production upon the type exceeds that given to the growing of any single grain crop. The acreages reported for the different crops from counties dominated by the Miami clay loam indicate that the agricultural practice upon the type has become settled on the standard rotation of corn, followed by a small grain, succeeded by two or more years of grass production. Large areas of the type are also devoted to permanent pasture and dairying and stock raising constitute important industries. In those counties of which soil surveys have been made in the region dominated by the Miami clay loam, the average yield of corn is in excess of 40 bushels per acre, winter wheat yields 17 bushels an acre on the average, oats produce an average yield of 35 bushels, and hay returns an average yield in excess of 1.3 tons per acre. All of these average county yields are somewhat exceeded by the Miami clay loam. It thus constitutes an extensively developed and important American soil type, fully 80 per cent of whose area is occupied for some form of tillage.

THE MARSHALL SILT LOAM.

The Marshall silt loam is, without doubt, the most extensive single type of soil to be found within the limits of the United States. The region within which this soil dominates all others extends from west-central Indiana, through central and northern Illinois, across northern Missouri and southern Iowa, and well into central Nebraska and northeastern Kansas. Within this territory an aggregate area of more than 4,000,000 acres has been mapped by the soil survey and it is probable that not less than 60,000,000 acres of the type exist in the region indicated.

The surface soil of the Marshall silt loam, to an average depth of 15 inches, consists of a dark-brown, chocolate-brown, or almost black silt loam. It is soft, friable, easily tilled, and well filled with organic matter. The subsoil is a lighter-colored, yellow, gray, or mottled silty loam or silty clay. This material normally extends to a depth of 6 or 8 feet, though it may possess a total depth of 20 or

30 feet over wide areas. Both surface soil and subsoil are stone free, and even the coarser grades of sand are almost totally lacking. Not infrequently concretions and accumulations of lime carbonate are found in the subsoil.

Throughout its entire extent the Marshall silt loam is marked by nearly level, slightly undulating, or gently rolling surface topography. The surface slopes are usually sufficient to afford adequate natural drainage without giving rise to erosion, and fully 90 per cent of its surface may be tilled with the heaviest and most efficient equipments of labor-saving farm machinery. Hundreds of thousands of acres of the level portion of the type have been further improved by the installation of tile underdrainage.

The Marshall silt loam lies at altitudes ranging from 650 to 1,500 feet above tide level and the type occupies the central temperate climatic region, where rainfall ranges from 40 inches annually in the eastern portion to 25 inches annually toward its extreme western limits.

The Marshall silt loam is the great, dominant, Indian-corn producing soil of the central prairie States. Throughout the region where it occurs the yields of this crop, reported from the Marshall silt loam, are not only above the yields reported from any other extensive soil type, but they are so high that the counties principally covered by the Marshall silt loam are the premier corn counties of these States.

In all cases it may be asserted, without fear of contradiction, that the corn yields upon the Marshall silt loam throughout its extent exceed the yields secured upon any other single extensive type of soil. In fact, a very large proportion of the annual corn supply of the United States is secured from States and counties where corn production is principally developed upon this soil.

The other great crops produced upon the Marshall silt loam are: Oats east of the Missouri River, winter wheat in northern Missouri and eastern Kansas and Nebraska, and grass universally.

The standard crop rotation consists of the growing of corn for two or more years, the sowing of oats or wheat, and the seeding down to grass, usually mixed timothy and clover, but frequently clover alone or alfalfa alone in the more western areas.

The principal live-stock interests based upon this soil and its products are the fattening of beef cattle and the production of swine. Dairying and sheep raising are distinctly subordinate industries.

THE CARRINGTON LOAM.

The Carrington loam is a widely developed type of soil in the more northern portion of the central prairie States. Practically all of the extensive areas of the type are to be found in the region between the Mississippi and Missouri Rivers from central Iowa northward. It is also found to a limited extent around the southern end of Lake Michigan.

A total area of 1,601,088 acres of the Carrington loam has been mapped by the soil survey, and it is probable that more than 25,000,000 acres of this soil will be found to exist, chiefly in northern Iowa, southern Minnesota, and in the eastern portions of North Dakota and South Dakota.

The surface soil of the Carrington loam, to an average depth of 12 inches, is a very dark brown to black mellow loam. The subsoil is a brown or yellowish-brown compact loam, which grades downward into a compact mass of clay, sand, gravel, and bowlders. The type is derived through the weathering of deep glacial till which covers the greater portion of the region occupied by the Carrington loam to depths ranging from 10 feet to 150 feet. Both the surface soil and the subsoil contain gravel and small bowlders, and the type is thus readily distinguished from the stone-free Marshall silt loam with which it is frequently associated.

The Carrington loam is uniformly gently undulating or slightly rolling over the greater part of its extent. Locally low ridges and lines of hills, marking the position of glacial moraines, cross the areas of the type. Owing to the slightly rolling character of the surface, drainage has become well established, although small ponds and swamps occupy depressed areas. There is quite a range in the absolute elevation of the type above sea level. Around the lower end of Lake Michigan the elevations range from 650 to 800 feet above tide level, while in northern Iowa and southern Minnesota the altitudes range between 1,000 and 1,250 feet, and in the Dakotas attain to 1,600 feet above the sea.

The Carrington loam occurs under varying conditions of latitude, altitude, mean annual rainfall, and length of growing season. Consequently there is quite a variation in the adaptation of the type to crops. In all of the more southern localities in which it occurs, corn constitutes the dominant crop upon the Carrington loam, while winter wheat, oats, and hay are also grown in rotation. In Minnesota and the Dakotas spring wheat dominates all other crops, barley and flax are extensively grown, while corn, because of climatic conditions, occupies only a subordinate acreage.

Within the climatic region suited to corn production the yields upon the Carrington loam average from 35 to 45 bushels per acre over extensive areas, while yields in excess of 50 bushels per acre are of frequent attainment.

Although the Carrington loam does not rank as a great dominant corn soil, like the Marshall silt loam, it ranks high both in the acreage planted annually and in the acreage yields secured.

The Carrington loam is one of the great wheat-producing soils of the United States. Owing to its extensive development under different climatic conditions, both winter and spring wheat are produced upon it; the former in Michigan, Indiana, and Iowa, and the latter in northern Iowa, Minnesota, and the Dakotas. In fact, the Carrington loam is known as an excellent wheat soil wherever it occurs, not only because of high yields, but also because of the superior quality of the grain.

South of the wheat-growing region, oats constitute the dominant small-grain crop upon the Carrington loam, while barley is extensively grown both in Minnesota and in the Dakotas.

Grass is universally grown upon the type and the yields of mixed timothy and clover attain to the high average yield of 1½ tons per acre in many counties dominated by the Carrington loam.

The Carrington loam may thus be characterized as one of the most extensive soil types occurring in the more northern portion of the Central States. It is well suited to the production of each of the most important staple crops of the region where it occurs. The selection of the specific group of crops to be grown upon the type is dependent chiefly upon the attendant climatic conditions, since corn, spring wheat, winter wheat, oats, barley, flax, and hay are all adapted to production upon it. No single crop has yet risen to preeminence as a product of the Carrington loam, although spring wheat is most extensively grown.

THE FARGO CLAY LOAM.

The Fargo clay loam is an ancient glacial-lake sediment deposited in the present valley of the Red River of the North and in numerous smaller drained lake basins in Minnesota, North Dakota, and South Dakota. An area of 601,024 acres of this type has been mapped by the soil surveys and it is developed to a total extent in excess of 5 million acres, chiefly in the Red River Valley.

The surface soil is a deep, dark-brown clay loam containing an appreciably large quantity of organic matter. This surface soil has a depth of 12 to 24 inches, and is underlain by a heavy silty clay of variable color, usually gray or drab. This subsoil is highly calcareous, and its carbonate of lime content has been found to range from 3½ to 24 per cent.

In all the areas where it occurs the Fargo clay loam is marked by the almost level character of its surface. The maximum slopes are not usually in excess of 2 or 3 feet to the mile, while extensive areas possess a slope not over 1 foot to the mile. Into this plain the major streams have cut their channels to depths varying from 20 to 50 feet.

The absolute elevation of the Fargo clay loam above tide level ranges from 975 feet along the international boundary line to altitudes of 1,100 feet in the southern portion of the Red River Valley and of 1,200 feet in certain of the smaller detached areas. The drainage of the type, particularly within the broad level areas, is frequently defective.

The uses of the Fargo clay loam are somewhat limited by its climatic surroundings and by the natural drainage conditions. In consequence, spring wheat exceeds in acreage that of all other crops combined; in fact, it is the one crop of paramount importance. Barley and oats are also grown, giving good yields, and a large proportion of the flaxseed produced in the United States is grown upon this soil. The climatic difficulties attendant upon the production of corn in such a high latitude have limited the acreage devoted to this crop.

In the pioneer days spring wheat was the one universal crop grown for sale. Taking advantage of the great natural fertility of the soil, the prairie sod was broken and wheat was grown year after year, with no alternation or rotation of crops. The land was plowed and lightly harrowed, though frequently the seed was sown directly upon the overturned furrow. High yields were secured, but these gradually decreased until a tendency toward the general adoption of crop rotation is now shown. At present the average yield of spring wheat is about 15 bushels per acre. Climatic conditions largely control, and yields range from 8 bushels to 20 bushels, varying with the season.

Over all of the poorly drained areas the wild grasses are cut, yielding from 1 ton to 1¼ tons of hay per acre. Flax yields 10 or 12 bushels of seed per acre, oats 25 to 40 bushels, and barley averages about 25 bushels per acre. Spring wheat remains the dominant crop, and it is probable that the Fargo clay loam is more universally devoted to the production of this crop than any other soil in the United States.

AN IMPORTANT LIMESTONE VALLEY SOIL.

THE HAGERSTOWN LOAM.

The Hagerstown loam is the most extensive of the valley limestone soils. It dominates the Great Valley, which extends from southeastern Pennsylvania, through Maryland and Virginia, into eastern Tennessee and northern Alabama. It is also the dominant soil of the bluegrass region of north-central Kentucky and of the basin region of central Tennessee. It has been mapped by the soil survey to the extent of 1,211,911 acres, and it is probable that more than 10,000,000 acres of the type exist in the valley regions associated with the Appalachian Mountains and Plateau.

Throughout the region of its occurrence the Hagerstown loam is characterized by a brown or a yellowish-brown silty loam surface soil. This has a depth varying from 6 inches to 12 or 14 inches. It is soft and mellow, nearly or quite stone free, and well charged with organic matter. The surface soil grades downward into a heavy yellow loam or clay loam subsoil, which, in turn, grades into a heavier clay loam or clay subsoil at a depth averaging 2½ feet. The deep subsoil usually rests upon limestone rock.

Although the Hagerstown loam is a valley or basin soil, its surface is rarely level. It is usually undulating to rolling, and the surface drainage is excellent without any serious difficulty from erosion. Low ridges and isolated hills break the monotony of the valley topography. In absolute elevation the surface of the type ranges from 150 feet to 1,000 feet above sea level.

The Hagerstown loam is one of the most fertile of the eastern soils. Its long-sustained crop-producing power has given rise to the saying, "a limestone soil is a fertile soil." This is true of the Hagerstown loam, but not necessarily true of all soils derived from limestone rocks.

Since early colonial days the Hagerstown loam has been highly prized as a general farming soil. Its principal crops for nearly 200 years have been corn, winter wheat, and hay. It has always maintained a profitable live-stock industry. Beef production in the more eastern localities and the production of horses, mules, and beef cattle in Kentucky and Tennessee are marked features of the agricultural system developed upon the type.

Corn is the principal grain produced. Even after 200 years of cultivation in southeastern Pennsylvania the average corn yield upon the Hagerstown loam exceeds 50 bushels per acre, while yields of 75 to 80 bushels are nowise uncommon. The Hagerstown loam is also a dominant wheat soil in the Eastern States, producing from 20 to 35 bushels of winter wheat per acre and maintaining an average yield in excess of 25 bushels.

The grass-producing capacity of the type is, probably, its most widely known characteristic. The Kentucky bluegrass is peculiarly adapted to this soil, and pastures seeded to this grass maintain a large number of grazing animals. The type is no less suited to the growing of mixed timothy and clover, while clover and alfalfa, seeded alone, are very productive. Yields of $1\frac{1}{4}$ to 2 tons per acre of mixed grasses are common on the best-farmed areas of the type.

The uses of the Hagerstown loam are not confined to the practices of grass and grain growing and of dairying and stock raising. Fruit trees, particularly apples, are grown to advantage upon the type, and the extension of apple orcharding upon it has been marked during the last decade.

The Hagerstown loam has dominated the crop-rotation practices of the regions within which it occurs. Upon it the clovers and timothy have been grown in rotation with corn and wheat for upward of two centuries. It was among the earliest of eastern soils to be tilled with the well-ordered and soil-sustaining rotation of an intertilled crop (corn), followed by a small grain (winter wheat), followed by two or more years in mixed timothy and clover. The success of this rotation, coupled with the manuring and liming of the soil, is attested by increased crop yields after 200 years of tillage.

IMPORTANT SOILS OF THE COASTAL PLAINS.

THE NORFOLK FINE SANDY LOAM.

The Norfolk fine sandy loam extends from eastern Virginia southward along the Atlantic coast to northern Florida and thence westward through the Gulf region to eastern Texas. Soil surveys throughout this region have encountered a total area of 4,346,572 acres and it is probable that not less than 30,000,000 acres of the Norfolk fine sandy loam will be found to exist in the South Atlantic and Gulf States.

The type is derived from sandy marine sediments which have been elevated above sea level in the lower-lying coastal country and its surface rises from near sea level to altitudes of about 350 feet.

The surface soil of the Norfolk fine sandy loam to a depth of 6 or 8 inches is a pale-yellow or light-gray fine sandy loam. It is underlain by a light-yellow fine sandy loam, which grades down into a friable yellow sandy clay at a depth of about 18 inches. The surface of this soil is nearly level or gently rolling, and it is possessed of excellent natural drainage over the greater portion of its area.

The Norfolk fine sandy loam is one of the best general farming soils of the region in which it occurs. Owing to the wide range of latitude within which it is developed there is quite a diversity in its crop adaptations. In the eastern counties of Virginia and North Carolina it is used for the production of corn, winter oats, cowpeas, peanuts, and the bright cigarette tobacco. From the southern boundary of Virginia to eastern Texas it is a highly prized cotton soil. Where local transportation facilities are adequate it is also intensively farmed for the production of the vegetables and small fruits produced for shipment to northern markets.

The yields of cotton from this soil vary from one-third to three-fourths of a bale per acre, while yields in excess of 1 bale have been grown. Corn yields from 20 to 35 bushels per acre, with occasional yields as high as 45 bushels. Peanuts yield 30 to 100 bushels per acre, depending somewhat upon the variety grown. The bright cigarette tobacco produces 500 to 1,200 pounds per acre of high-grade leaf. Winter oats are frequently sown as a cover crop to be grazed off in spring or to be mown for hay. Cowpeas yield 1¾ to 2 tons of hay per acre.

Among the trucking crops early Irish potatoes are grown upon the Norfolk fine sandy loam from Florida northward, giving yields ranging from 90 to 150 bushels per acre. In eastern North Carolina lettuce is an important winter forcing crop, giving yields valued at $800 to $1,200 per acre.

Sweet potatoes, cantaloupes, and watermelons are also grown with profit. Peaches constitute the most important tree fruit, while pecans have proven to be well suited to this soil, especially in the central Gulf coast region.

In spite of the wide variety of general and special crops which may be grown upon the Norfolk fine sandy loam, cotton remains the dominant money crop produced upon it throughout the areas where the climate is suitable. Only where the climate is unsuited to cotton production or where special conditions of crop demand or of transportation facilities exist are the special crops strongly developed. Thousands of acres of this soil type are either occupied only for cotton production or not at all, constituting one of the most valuable land reserves for intensive agriculture and the production of food crops yet remaining in the Eastern States.

THE ORANGEBURG FINE SANDY LOAM.

The Orangeburg fine sandy loam is found at the higher elevations within the Atlantic and Gulf Coastal Plains from North Carolina to east central Texas. It usually lies at considerable elevation above tidewater and is found at some distance inland from the coast. It has been encountered in 50 different soil-survey areas located in 10 different States and has been mapped to the extent of 2,507,840 acres. It is probable that its total area exceeds 15,000,000 acres.

The surface soil of the Orangeburg fine sandy loam to an average depth of 10 or 12 inches is a gray or brown fine sandy loam. It grades downward into a dark-red fine sandy clay, which may be underlain at a depth of 3 feet or more by a stiff red clay. The surface of the type ranges from gently rolling to somewhat hilly, and, as a general rule, it is well drained. Erosion is frequently excessive upon the steeper slopes. The surface of the type ranges from 150 to 500 feet above sea level.

All of the more extensive areas of this soil occur in the warm temperate region, where the growing season is long and the rainfall is amply adequate for crop production.

The Orangeburg fine sandy loam is one of the most important cotton-producing soils of the timbered Coastal Plains region. In the production of this crop it is only equaled or excelled by the Norfolk fine sandy loam of the Atlantic and eastern Gulf section and by the Houston black clay of the Cretaceous prairie region of southern Oklahoma and central Texas. For the purposes of diversified farming, with cotton as a dominant money crop, few southern soils equal the Orangeburg fine sandy loam. Its qualifications for such purposes are numerous. The surface of this soil is sufficiently rolling to possess excellent natural surface drainage without being so hilly as to be subject to serious erosion or to offer any natural obstruction to the cultivation of large areas. The surface soil is mellow, friable, and easily maintained in good tilth. It is open and absorbs a large proportion of the rain which falls upon its surface. It is sufficiently friable to prevent baking and clodding, while its internal drainage is adequate so that tillage operations may be undertaken almost immediately after a season of rain. The presence of the sandy clay subsoil, and even of clay at greater depths, retards the downward percolation of moisture and holds an adequate supply within the subsoil during the entire period of growth of the cotton plant. The surface soil is sufficiently sandy to be warm and well drained and to force the plant to early growth without giving an excessive plant growth at the expense of fruiting.

There is a wide variation in the efficiency with which this soil is tilled. New land of this type, when first planted to cotton, yields in excess of one-half bale per acre. Upon the best managed farms, even after generations of cotton production, yields of one-half bale to one bale per acre are frequent. With poor management yields sink to two-fifths bale per acre. The soil itself, under normal conditions of cultivation, is capable of producing in excess of one-half bale per acre. Smaller yields mark inadequate management.

Corn yields upon the Orangeburg fine sandy loam are relatively lower than those of cotton. Yields as low as 8 bushels per acre are reported, while yields of 70 to 80 bushels per acre have been produced. The average yield for the type is probably about 20 bushels per acre. Winter oats are grown as a cover crop and for forage purposes, and cowpeas are grown for hay.

Within recent years cigar-filler tobacco of the Cuban type has been successfully grown upon the Orangeburg fine sandy loam, with yields ranging from 500 to 1,200 pounds per acre. It is also one of the best soils in the Coastal Plains for the production of peaches. Successful commercial orchards have been planted upon it in Georgia, Alabama, Mississippi, and Texas.

Thus the Orangeburg fine sandy loam is an important and extensive general farming soil throughout the South Atlantic and Gulf States, with cotton the dominant money crop.

THE HOUSTON BLACK CLAY.

The Houston black clay is the most widespread and important of the soils found in the calcareous prairie region of southern Oklahoma and central Texas. A total area of 1,402,392 acres of this soil has been encountered in the soil surveys and it is probable that its total extent exceeds 15,000,000 acres.

The surface soil of the Houston black clay is a drab, dark-brown, or jet-black clay extending to an average depth of about 10 inches. This soil is plastic and waxy when wet, and is locally known as the "black waxy soil." When well tilled and in a moderately moist condition it becomes granulated and friable. The underlying subsoil is a drab, brown, or gray tenacious clay which grades into marl or chalk at a depth little exceeding 3 feet. Throughout its extent the subsoil is unusually calcareous, analyses showing from 2 to 30 per cent of calcium carbonate. The surface soil is usually well supplied with organic matter.

The surface of the Houston black clay is nearly level or gently undulating. Broad, swelling ridges are separated by gently sloping valleys or by broad tracts of almost absolutely level prairie. The type is fairly well drained, though the tenacious waxy clay retains large amounts of moisture in soil and subsoil. Erosion is not a serious problem with this soil.

The Houston black clay lies chiefly within a region adequately supplied with rainfall, though the extreme southwestern extension of its occurrence lies within the subhumid region.

This soil was first occupied for the grazing of vast herds of cattle. At a later date more intensive forms of agriculture followed the subdivision of the prairie ranches into farms. At present cotton is the dominant crop grown, and it is probable that no other single soil in the world is, at present, producing so many bales of cotton annually as the Houston black clay. Within the region dominated by this type the cotton yield exceeded 50 bales per square mile, according to the census of 1900. Only limited areas within the alluvial bottom lands exceeded this volume of production. For periods ranging from 25 to 50 years extensive areas upon this soil have yielded from one-half bale to one bale of cotton per acre, usually without fertilization and frequently with no rotation of crops. Numerous authentic yields in excess of one bale per acre have been reported.

Next to cotton, corn is the crop most universally grown upon the Houston black clay. The type possesses all of the essentials of a first-class corn soil and, among southern soils, most closely approximates the soil conditions prevalent in the "corn belt" of the central prairie States. It is well charged with organic matter, retentive of moisture, calcareous in the subsoil, fairly well drained, and extensively developed in large level tracts suited to the use of power machinery for the preparation of the land and the cultivation of the crop. The yields of corn secured range from 25 to 50 bushels per acre, with an average yield in excess of 30 bushels per acre over extensive areas. As corn is normally considered to be subordinate to cotton throughout the areas where the type is developed, this yield is comparatively high. Better methods of land preparation, of tillage, of crop rotation, and of seed selection result in yields which compare favorably with those of the "corn belt."

The Houston black clay is a dominant cotton soil, and it is destined to become a dominant southern corn soil.

The growing of alfalfa upon the type is of comparatively modern date. Yet this soil possesses all of the essentials for alfalfa production with the exception that the dense subsoil is somewhat unfavorable. The better drained and more rolling areas of the Houston black clay are unusually well adapted to the crop.

Diversified and intensive farming are only in the initial stages of development upon this type. Increased yields of cotton and of corn may be anticipated through further diversification of crop interests, resulting in the much to be desired adoption of a crop rotation in which cotton, corn, and alfalfa constitute the elements.

GENERAL CONSIDERATIONS.

The discussion of important American soils has been confined in this article to those of wide areal extent and of general adaptation to the production of the most important staple crops. While certain of the soils discussed are also suited to the production of special crops, their general characteristics adapt them particularly to other forms of agriculture. No account is given in the present paper of any of the typical special-crop soils, although they possess a high degree of importance for particular purposes, and although many of them are extensively developed, of high acreage value, and of great economic importance. Thus, there have been omitted such important soils as the Norfolk fine sand, which dominates the production of early truck crops along the Atlantic seaboard; the soils of the Portsmouth series, which are important small-fruit and late-truck soils; the soils of the Porters series, which constitute valuable apple-orcharding soils in the Blue Ridge section; the soils of the Dunkirk series, which are not only important as general farming soils, but also constitute the most highly developed vineyard and apple-orchard lands in the region of the lower Great Lakes; the soils of the Clyde series, which are of particular importance in the southern peninsula of Michigan for the production of sugar beets, celery, onions, and other special crops; the Wabash clay, which is the dominant sugar-cane producing soil of the lower Mississippi delta; and the Crowley silt loam, which is the most important rice-growing soil of Louisiana and Arkansas. Each of these soils or groups of soils possesses a great special value for the more intensive forms of agriculture as contrasted with the general agricultural value of the eight types which have been discussed.

The North Central States, which constitute the great grain-growing section of the country, are dominated, in areal extent, in crop production per acre and in the percentage of the several crops grown by four important soils. While it may not be asserted that these soils produce the major portion of the cereal crops, yet each is such a large producer that the large number of other soils tilled for the production of the staples are dwarfed in individual importance by the Miami clay loam, the Marshall silt loam, the Carrington loam, and the Fargo clay loam. Upon these four soils so great a proportion of the corn, the wheat (both winter and spring), the barley, the oats, the hay, and the flax is grown that to remove these soils from the production of these crops would seriously disturb the agricultural potentiality of the Nation.

Because of the extensive distribution and high producing capacity of the Hagerstown loam its agricultural performance has popularly come to typify the capacity of limestone soils. It is a soil which has dominated the agricultural production, practices, and ideals of many of the older eastern agricultural communities from a time antedating the formation of the Federal Union. Its crop-producing capacity has been sustained at a high mark longer than that of any other extensive American soil. Upon it important crops like corn, wheat, and clover have reached their acme of production earlier than upon any other soils of great areal extent. It now sustains as high a type of complete agriculture as has been established within the country, and its crops, its animals, and its homesteads are all of unusually high average excellence.

The cotton-growing section of the Atlantic and Gulf Coastal Plains is dominated by three widely developed and productive general farming soils upon each of which cotton is the crop most extensively grown. Along the south Atlantic seaboard the Norfolk fine sandy loam is a dominant type of soil in total acreage, in diversity of cropping interests, and in acreage yields of the important staple crops. Within the central portion of the Gulf Coastal Plain the Orangeburg fine sandy loam occupies a similar position. In the extreme western part of the cotton belt the Houston black clay is preeminent among all upland soils devoted to cotton production, while it attains to an increasing importance as a soil suited to corn and alfalfa. All three of these soil types are marked not only by present producing capacity and usually by comparatively complete occupation, but each is capable of further extension either of cultivated area or of more diversified, more intensive, and more profitable agricultural occupation.

These eight soils will ultimately be found to cover nearly or quite one-fifth of the arable agricultural domain of the United States east of the ninety-eighth meridian, if the estimates based upon the extent of their acreage within areas covered by the soil surveys is not materially changed by the completion of additional surveys. Because of the great area of these few types, because each soil is preeminently adapted to the production of some great staple crop or group of such crops, because the problems attendant upon the production of each of such crops will be more easily solved upon such homogeneous soil areas than upon a diversity of minor types, the agriculture of the Nation is destined to be influenced more and more by these soils and by the farmers engaged in their cultivation.

BIRD ENEMIES OF THE CODLING MOTH.

By W. L. McAtee,
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RELATION OF BIRDS AND INSECTS.

Most birds are to some extent insectivorous, and many species live almost exclusively upon insects. There is no doubt that their combined attack has an important influence on the numbers of the insect army. In spite of birds and other enemies, however, it not rarely happens that certain insects suddenly increase in numbers and threaten great damage locally to crops. Instances of the suppression by birds of such strictly local outbreaks of insects are numerous. Rarely, however, do they exercise a noticeable degree of control over an insect so widely distributed and so important economically as the codling moth. Nevertheless, since 1746 nearly all entomologists who have published accounts of the codling moth have paid high tribute to its avian enemies, and they are almost unanimous in declaring birds to be the most efficient natural enemies of the pest.

LOSSES DUE TO THE CODLING MOTH.

The experts of the Bureau of Entomology state that the codling moth causes greater loss to apples and pears than all the other insect enemies of these fruits combined. They estimate the damage the insect does to the apple crop of the United States at approximately $12,000,000 annually.[1] If account be taken of expenses incurred in attempts to control the insect, as for labor, arsenicals, and spraying apparatus, an additional sum of probably not less than $3,000,000 or $4,000,000, or a total of at least $15,000,000, must be charged to the presence of this insect in the apple orchards of the United States.

LIFE HISTORY OF THE CODLING MOTH.

The life history of so important a pest has, of course, been carefully studied. It has been found by entomologists that as a rule the eggs are laid upon the leaves or the fruit. There are usually two broods of the insects and consequently two periods of oviposition, namely, in early spring and in midsummer. The eggs hatch in

[1] Yearbook, U. S. Dept. Agric., p. 435, 1907.

from 9 to 18 days, and the minute larvæ immediately hunt for the fruit. Those finding it bore in at once and spend from 10 to 30 days feeding upon the seeds and flesh around the core. At maturity the larvæ emerge, chiefly at night, and seek sheltered places, such as holes or cracks in the trees or ground, crevices under bark scales on the trunk, or refuges under boards or other litter on the ground in which to spin their cocoons. (Pl. X, figs. 2 and 3.) Here they either pupate at once in preparation for the second brood of the season, or, if winter is near, pupation is postponed till the following spring. The adults fly mostly by night.

DESTRUCTION OF LARVÆ BY BIRDS.

Thus the nocturnal habits of the species in its active stages and the fact that it is hidden at other times leave few opportunities for birds to attack it. In spite of this, however, birds destroy great numbers. Some larvæ are no doubt captured during the interval between emergence from the fruit and spinning the cocoon, but as this period is brief and usually occurs at night, a great majority of them probably reach a hiding place in safety. But woodpeckers drill through the bark flakes under which larvæ or pupæ lie in their cocoons, or enlarge cracks that shelter large numbers of these insects in immature stages, and the titmice, chickadees, nuthatches, and creepers find them in shallow crevices or by prying off loose scales of bark. Probably most of the other birds, also, which feed upon the larvæ and pupæ get them chiefly by these latter methods.

WOODPECKERS.

The most effective enemies of codling moths are those that can best attack them in their pupal chambers. It is not surprising, therefore, that woodpeckers, accustomed as they are to obtaining their food from crevices and under bark flakes, should take high rank among the foes of this pest. (Pl. XI.)

Roesel, the first man who published an accurate account of the codling moth, noted the beneficial work of woodpeckers. He says of the larvæ seeking places to pupate: "They conceal themselves so thoroughly as scarcely to be found by men; but the woodpeckers and similar birds know how to discover quickly their retreats."[1]

Trimble, an American investigator, was the first to ascertain how the downy woodpecker "finds where to peck through the scales of bark, so as to be sure to hit the apple worm that is so snugly concealed beneath." After stating that the sense of smell will not account for it, he says:

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[1] Roesel von Rosenhof, A. J. Insecten-Belustigen: 1ter Theil, Der Nachtvögel, 4te Classe, No. 13, p. 36, 1746.

This little bird finds the concealed larvæ under the bark, not from any noise the insect makes; it is not a grub of a beetle having a boring habit and liable to make a sound that might betray its retreat, in seasons of the year when not torpid. A caterpillar makes scarcely an appreciable noise, even when spinning its cocoon, and when that is finished it rests as quietly within as an Egyptian mummy in its sarcophagus. There is no evidence that the downy woodpecker ever makes a mistake; it has some way of judging. The squirrel does not waste time in cracking an empty nut. There is no reason to believe that this bird ever makes holes through these scales merely for pastime or for any other purpose except for food. He knows before he begins that if he works through, just in that spot, he will find a dainty morsel at the bottom of it, as delicious to him as the meat of the nut is to the squirrel. But how does he know? By sounding—tap, tap, tap, just as the physician learns the condition of the lungs of his patient by what he calls percussion. . . . Watch him. See how ever and anon he will stop in his quick motions up and down, and give a few taps upon the suspected scale, and then test another and another, until the right sound is communicated to that wonderful ear.[1]

Dr. Trimble examined the stomachs of three downy woodpeckers and found codling-moth larvæ in two of them. This was in the sixties; the observation has been confirmed many times since, and the downy has been praised on all sides. Well does he deserve appreciation. In most apple orchards in the United States in fall and winter the sound of the tapping of the downy woodpecker may be heard almost every day, and many a codling-moth larva or pupa do the birds devour. The insects have been found in stomachs of this species from New York, New Jersey, Texas, and California, and no fewer than 20 larvæ have been taken from a single stomach. The downy woodpecker not only gets codling worms from the trunks of apple trees, but takes them from the fruit itself.

F. M. Webster notes that Mrs. S. H. Hine, of Sedan, Ind., a most careful observer of birds, stated that she had seen this species feeding on these larvæ, extracting them from apples which were hanging to the tree. She had watched a downy woodpecker on a tree in her yard until it worked upon an apple within her reach, and, keeping her eye on this apple, she had approached the tree and picked it. She found that the young larva had made some progress into the fruit, starting from the calyx, but that it had been deftly extracted by the woodpecker and without injury to the fruit. Mr. Webster says further:

In a conversation with Judge McBride, of Elkhart, Ind., also a careful observer of birds, he stated that he had also observed downy woodpeckers extracting the worms from young apples, and he had never observed that in so doing the birds in any way injured the fruit. It seems, then, that the labors of this bird act not only as a preventive, but also afford actual and immediate relief to the infested fruit.[2]

[1] Trimble, Isaac P. Treatise on the Insect Enemies of Fruit and Fruit Trees, pp. 116–117, 1865.

[2] Insect Life, III, p. 348, Apr., 1891.

Two western species of woodpeckers also are known to extract larvæ in the same way. Mr. W. Otto Emerson, of Haywards, Cal., in a letter to the Biological Survey, dated March 14, 1909, says:

> Several cases have come under my observation when in the fall months * * * the California and Lewis woodpeckers made their appearance in canyon apple orchards and went through them, picking open the apples for the codling-moth worms they contained.

Other woodpeckers known to feed on the codling-moth larvæ are the hairy woodpecker (*Dryobates villosus*), Texan woodpecker (*Dryobates scalaris bairdi*), red-headed woodpecker (*Melanerpes erythrocephalus*), red-shafted flicker (*Colaptes cafer collaris*), and pileated woodpecker (*Phlœotomus pileatus*). Plate XI illustrates work of woodpeckers, probably mostly that of the pileated, in search of codling-moth larvæ. The red-shafted flicker is given great credit by Mr. A. P. Martin, of Petaluma, Cal., who—

> writing to the Pacific Rural Press of June 27, 1890, states that in looking over his orchard last spring and examining all crevices and bark of the trees for the codling-moth larvæ, he failed to find any, where there were thousands last fall. He discovered plenty of cocoons, but in every case the former occupant was absent. It was too early for transformation to have taken place, and he found small holes in the bark scales which had been made by some bird. His belief is that the good work was done by a bird whose scientific name he does not know, but which is variously called the "yellow hammer," "flicker," or "high hole," and which Dr. Merriam informs us is, in California, *Colaptes cafer*. During the early spring months Mr. Martin states that they were to be seen by hundreds in his orchard, industriously examining the trunks and larger limbs of the fruit trees, and he also found great numbers of them around sheds where he stored his winter apples and pears. As the result of several hours' search Mr. Martin found only one worm, and this one escaped only by an accident, for several had been within a quarter of an inch of it.[1]

So eager are woodpeckers in search of codling worms that they have often been known to riddle the shingle traps and paper bands which are placed to attract the larvæ about to spin cocoons. In fact, the beneficial work of woodpeckers in relation to this pest has everywhere been so conspicuous as to call forth laudations of the birds and recommendations for protecting them and attracting more of them to the orchards.

FLYCATCHERS.

One would not expect birds so expert in catching insects on the wing to resort much to tree trunks for food, but at least two species, the kingbird (*Tyrannus tyrannus*) and the western yellow-bellied flycatcher (*Empidonax difficilis*), are known to prey upon the codling moth. No fewer than 15 larvæ were found in the stomach of a bird of the latter species collected at Haywards, Cal., in September.

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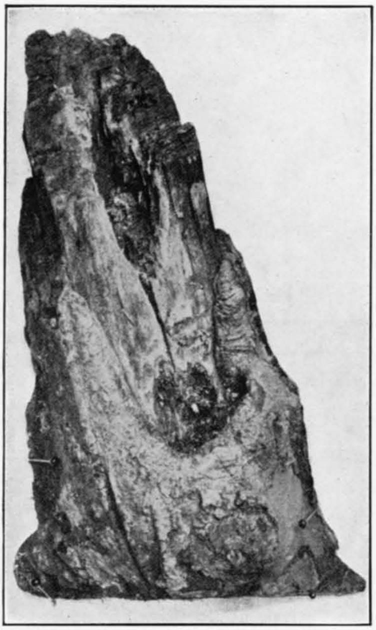
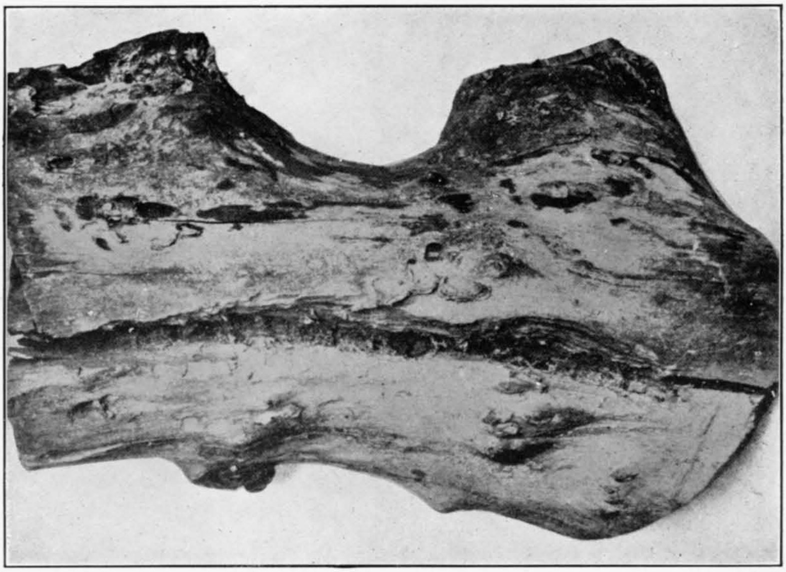
[1] Insect Life, III, pp. 79–80, Sept., 1890.

FIG. 1.—LARVA. (3 TIMES NATURAL SIZE.)

FIGS. 2 AND 3.—PUPÆ UNDER BARK SCALES.

LARVA AND PUPÆ OF CODLING MOTH.





HOLES AND CRACKS IN TREES ENLARGED BY WOODPECKERS SEARCHING FOR CODLING MOTH LARVÆ AND PUPÆ.

THE CROW FAMILY.

The blue jay (*Cyanocitta cristata*), the California jay (*Aphelocoma californica*), and the magpie (*Pica pica hudsonia*) give the crow family representation among codling-moth enemies. It is reported that in the State of Washington magpies frequently tear loosely fastened bands off the trees while searching for the hibernating larvæ.[1] Pupæ of the codling moth have been found in several stomachs of the California jay, collected at Haywards, Cal., in May.

BLACKBIRDS AND ORIOLES.

Three species of this family are on the list of foes of the apple worm, namely, the crow blackbird (*Quiscalus quiscula*), Brewer blackbird (*Euphagus cyanocephalus*), and Bullock oriole (*Icterus bullocki*). Pupæ were found in the stomachs of many Brewer blackbirds collected at Haywards and Watsonville, Cal., in May and June. Twenty-six Bullock orioles taken in the same localities from April to August had eaten enough pupæ and larvæ of the codling moth to make about 20 per cent of their food. One of these birds had taken 14 larvæ and pupæ.

THE SPARROW FAMILY.

Members of this family that prey upon the codling moth are: English sparrow (*Passer domesticus*), chipping sparrow (*Spizella passerina*), California towhee (*Pipilo crissalis*), cardinal (*Cardinalis cardinalis*), black-headed grosbeak (*Zamelodia melanocephala*), and lazuli bunting (*Passerina cyanea*). The adult California towhees, besides eating the pupæ of the codling moth themselves, feed them to their nestlings. Black-headed grosbeaks have the same habit and to such an extent that they rank among the most important enemies of the insect. No fewer than 12 larvæ were found in one stomach and 29 pupæ in another. Twenty-one black-headed grosbeaks collected at Haywards and Watsonville, Cal., in May, had made over 20 per cent of their diet of codling larvæ and pupæ.

SWALLOWS AND VIREOS.

On the Pacific coast the barn swallow (*Hirundo erythrogastra*) is said to catch adult codling moths, but probably its services in this direction have been overstated.

The stomachs of several western warbling vireos (*Vireosylva gilva swainsoni*), taken in California in April, May, and June, contained pupæ of the codling moth.

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[1] Melander, A. L., and Jenne, E. L. Bul. 77, Wash. Agr. Exp. Sta., p. 39, 1906.

WARBLERS.

Only two warblers, the summer or yellow warbler (*Dendroica æstiva*) and the lutescent warbler (*Vermivora celata lutescens*), are now known to prey upon codling moths, but it is certain that further study of the food of this much neglected family will add a considerable number of species to the list. The lutescent warbler shows a strong liking for the pupæ, two taken in California in May having eaten 10 and 18 pupæ, respectively.

CREEPERS AND NUTHATCHES.

Each of these families has a single species on the list of enemies of the apple worm, namely, the brown creeper (*Certhia familiaris americana*) and the white-breasted nuthatch (*Sitta carolinensis*). It is reasonable to suppose that all the subspecies of creepers and nuthatches will in time be found to eat codling larvæ and pupæ.

TITMICE AND CHICKADEES.

Next to woodpeckers, titmice are probably the most important enemies of the codling moth. Their habits of searching every nook and cranny, however small or difficult of access, and the thorough way they go over trees and stumps, enable them to find the favorite hibernating quarters of the larvæ. A description of their methods of hunting is given by Trimble, who remarks (p. 120), after detailing that he had taken 5 larvæ from the stomach of a black-capped chickadee (*Penthestes atricapillus*):

> The day had been dry and windy, following a warm wet day and night; and it is in just such weather that the bark of the buttonwood, shellbark hickory, and other shaggy trees will be found curling out and falling off.
>
> I have never seen anything that would lead me to believe that this minute bird makes the holes in the scales of bark that lead directly to the cocoons of these caterpillars; they are made by the downy woodpecker and probably by it alone. The chickadee most likely finds these worms only or chiefly on such days as this, when the warping of these scales exposes them to the prying eyes of these busy little friends.

Besides the black-capped chickadee, the following four species of this family are known to eat codling moth larvæ or pupæ: Plain titmouse (*Bæolophus inornatus*), Carolina chickadee (*Penthestes carolinensis*), mountain chickadee (*Penthestes gambeli*), and California bush tit (*Psaltriparus minimus californicus*).

Ten stomachs of the last-named species, examined by Prof. F. E. L. Beal, contained, on the average, 25 per cent of pupæ of the codling moth. Eight of these stomachs were of nestlings, containing pupæ as follows: Two stomachs contained 2 each, two contained 3 each, one contained 4, one 7, one 9, and one 11, making 41 in all, or an average of over 5 to each.

The economic value of these nestlings is commented upon by Prof. Beal as follows:

The oak tree in which these birds were found was in a belt of timber along a creek, and just across the stream was a considerable area of neglected orchard. It is evident that the parent birds used this orchard as a foraging ground and did their best toward remedying the neglect of the owner. As with nestling birds feeding and digestion are almost continuous during the hours of daylight, it follows that the above record would be several times repeated during a day's feeding There were probably not less than a dozen nests of the bush tit (several were seen) along the border of this orchard, and if, as is possible, the occupants all did as good work as the ones recorded, it is evident that the birds must exert a powerful restrictive influence upon the increase of the codling moth, as well as other insects.[1]

KINGLETS AND THRUSHES.

One species of kinglet, the ruby-crowned (*Regulus calendula*), eats codling larvæ, as do also two species of the thrush family—the robin (*Planesticus migratorius*) and the bluebird (*Sialia sialis*). The robin eats this insect in both the East and the West, and a stomach from Pullman, Wash., contained 11 larvæ.

EFFICIENCY OF BIRD ENEMIES.

We find that in the United States there are 36 species of birds, belonging to 13 families, that feed on the codling moth. The three important families seem to be woodpeckers, titmice, and sparrows. Probably, however, future investigation may place some other family, possibly warblers, among the first three.

We have shown that certain species, as the downy woodpecker, Bullock oriole, black-headed grosbeak, and bush tit, consume large numbers of codling-moth larvæ and pupæ. It is probably only because of insufficient investigation that the same can not be said of other birds. Although we can not accurately rank the species in importance, we can confidently declare their utility collectively.

Almost every entomologist who has written on the subject substantially agrees with Slingerland that "by far the most efficient aids to man in controlling the codling moth are the birds."[2] The two facts that have chiefly led to this conclusion are the great scarcity of intact hibernating cocoons and the abundance of empty ones which have evidently been rifled by birds. Long ago Walsh and Riley said:[3]

From the careful inspection of several large orchards in the early spring months, we are convinced that almost all of the cocoons of the apple-worm moth that have been constructed in the autumn on the trunks and limbs of apple trees are gutted of their living tenants by hungry birds long before the spring opens.

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[1] Bul. 30, Biol. Survey, pp. 79–80, 1907.
[2] Bul. 142, Cornell Agr. Exp. Sta., p. 41, 1898.
[3] American Entomology, I, p. 113, 1869.

In Virginia "counts of over 400 cocoons observed on apple trees revealed the fact that * * * birds had destroyed fully 85 per cent of the worms."[1]

From New Hampshire comes this report:[2]

> Only from 5 to 20 per cent of the larvæ survived the winter. An examination of 7 trees, which averaged over 38 cocoons per tree in the fall, showed but 5 per cent alive in the spring, 87 per cent having been killed by birds, 4 per cent by disease, and 3 per cent by cold. In another orchard 1,096 cocoons were examined in May, 1907, with 19 per cent alive, 66 per cent having been killed by birds, 6 per cent by disease, and 9 per cent by cold. It is quite evident that the birds, particularly the downy woodpeckers and the nuthatches, are the most important enemies of the codling moth in New England and that they should be given every protection and attracted to the orchard in every way possible. * * * They annually save us barrels of apples by destroying the apple worms under the bark in winter. They should therefore be encouraged and allured to the orchard whenever possible. Bits of suet and meat suspended from the trees will often attract them and sometimes help them through a hard winter.

Other measures recommended to aid birds in the warfare on this destructive moth are cementing up cavities suitable for the hibernation of the moth, thus forcing the larvæ to spin cocoons where birds can get them, and scraping off loose flakes of bark, especially those below the snow line, as under these the largest numbers of larvæ survive.

FOREIGN BIRD ENEMIES OF THE CODLING MOTH.

The suggestion has been made that foreign birds with an established reputation as codling-moth destroyers be imported into this country. The bird most frequently mentioned is the great titmouse or Kohlmeise (*Parus major*) of Europe. However, European records fail to show that this bird pays any particular attention to the codling moth. Moreover its food habits, while apparently beneficial on the whole, include some bad traits, such as eating bees, budding trees, attacking pears, and killing smaller birds. Thus the species is distinctly not a promising one for trial in the exceptionally hazardous field of international importation. Among foreign birds that have been definitely recorded as enemies of the codling moth are the European nuthatch (*Sitta cæsia*),[3] European wren (*Nannus parvulus*),[4] tree creeper (*Certhia familiaris*),[3 4 5] blue titmouse (*Cyanistes cæruleus*),[3 6] kinglets (*Regulus cristatus* and *Regulus*

[1] Buck, J. E. Ann. Rep. Va. Exp. Sta., p. 55, 1908.

[2] Sanderson, E. D. New Hampshire Agr. Exp. Sta. Bul. 143, pp. 64 and 82, 1909.

[3] Hooper, C. H. Reprint from Country Gentleman's Estate Book, pp. 5 and 16, London, 1907.

[4] Bos, J. Ritzema. Tierische Schädlinge und Nützlinge, p. 527, Berlin, 1891.

[5] Hooper, C. H. Agr. Students Gazette, new ser. 13, p. 123, 1907.

[6] Theobald, F. V. Text-Book of Agr. Zoology, p. 403, London, 1899.

ignicapillus),[1] one of the babblers (*Pomatorhinus superciliosus*),[2] the white-eye (*Zosterops cærulescens*),[3] and the white-throated tree-creeper (*Climacteris leucophæa*),[4] of Australia. Woodpeckers and sparrows are said to share in the work in Europe.

With three exceptions these birds belong to the same families as native species which we know devour the codling moth. These families are the creepers (Certhiidæ), nuthatches (Sittidæ), titmice (Paridæ), and kinglets (Sylviidæ). The United States already has a sufficient number of species of these families, besides numerous members of other families, which, if properly protected and encouraged, will probably destroy more codling moths than foreign species. To favor the increase and efficiency of our own useful species is not only far more profitable than to introduce foreign ones, but avoids the danger, acknowledged by all authorities as great, of opening our doors to a bird that in its new home may become obnoxious. It is a well-known fact that a very large number of our crop pests, both plant and animal, are imported. Furthermore, it is clear that the fundamental idea underlying proposals for introducing bird enemies of the codling moth is false. This idea is that each pest has some specific enemy or set of enemies which, if introduced, will control it to such a degree that the usual combative measures like spraying can be abandoned. This is a most alluring theory, but it is not borne out by practical experience. Birds exert a constant repressive influence on the number of insects, but those who expect either native or introduced birds to control a widespread insect pest to the degree necessary for the commercial success of the crop attacked will be disappointed.

SUMMARY.

Birds are recognized as the most effective natural enemies of the codling moth. In some localities they destroy from 66 to 85 per cent of the hibernating larvæ, and their work in large measure accounts for the small spring broods of the insect. This annual reduction in numbers of the pest is a very valuable factor in its control.

Thirty-six species of birds are known to prey upon the codling moth in the United States. These species belong to 13 families, of which the most important, so far as number of species on the list is concerned, are the woodpeckers, titmice, and sparrows. Especially valuable species are the downy woodpecker, Bullock oriole, black-headed grosbeak, and bush tit.

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[1] Bos, J. Ritzema. Tierische Schädlinge und Nützlinge, p. 527, Berlin, 1891.
[2] Curnow, S. H. Journ. Agr. S. Australia, p. 20, Aug., 1909.
[3] Emu, VII, pt. 1, p. 36, July, 1908.
[4] Journ. Agr. Victoria, IX, pt. 8, p. 552, Aug., 1911.

At least 10 species of foreign birds have been recorded as enemies of the codling moth, and there has been considerable agitation for the introduction of one or more of them. The importation of foreign species is, however, notoriously dangerous, and if successful would result in crowding out native species probably of greater value.

Exaggerated claims have been made for all sorts of natural enemies of insects, including birds, but all that can be truthfully claimed for them is that their influence is to lower the number of insect pests and hence is for the good. The amount of good done varies in different cases, and admittedly the bird enemies of the codling moth deserve the best protection and encouragement in recognition of their rank as the chief natural enemies of the pest.

SOME MISCONCEPTIONS CONCERNING DRY FARMING.

By E. C. Chilcott,
Agriculturist in Charge of Dry-land Agriculture Investigations, Bureau of Plant Industry.

INTRODUCTION.

During the past 25 years a large and ever-increasing movement to establish agricultural production in the semiarid region included in the Great Plains has been in progress in this country. A quarter of a century of consistent effort on the part of many people ought to have resulted in some material accomplishments. Either through some real success or through some of the failures that were to be expected in such a movement there should have been secured a store of experience that could serve as a foundation for future effort, but such does not appear to have been the case. Instead of a substantial fund of information based upon experience it would appear that there has been an accumulation of some very plausible theories and a number of "systems" of farming, both of which serve better as texts for discussion and preachment than as practical aids to the pioneer who ventures into the dry country in quest of a home and a means of livelihood.

Notwithstanding all that has been done in this region both by practical farmers and by scientific investigators, the available fund of reliable information is very inadequate. Instead of getting at the facts and steadily extending the boundaries of our knowledge there is a constant tendency to generalize broadly from any available information, and that, too, without determining whether the information is correct or not. Many of the claims and statements of self-seeking promoters, as well as of honest but overenthusiastic optimists, have been misleading and even false, and these have done more to obscure the facts and the real problems than the experiences of successful practical farmers and the investigations of scientists have done to elucidate them. Practical farmers are proverbially modest and conservative. They shun exploitation and publicity. Scientific investigators are usually conservative, if not always modest, and their published results and public statements appear to be unduly hedged about with qualifying phrases and guarded against general application. As a consequence the general agencies of publicity find their best source of material in those who are not hampered by the limitations of facts or experiences.

As a type of the unwarranted statements which have received wide publicity may be mentioned the one that a new and peculiar system of farming has been discovered or developed, which is of general application to all semiarid localities. Another is that all localities having an annual precipitation of more than 10 and less than 20 inches can be classed together as semiarid, regardless of latitude, altitude, distribution of precipitation, temperature, wind velocity, and evaporation. Still another is that the same methods of tillage are equally applicable to all soils and to the wide range of varying crop conditions. These conceptions are obviously entirely out of accord with all agricultural experience not only in semiarid but also in humid regions.

Agriculture has never yet been reduced to an exact science, even under the most uniform and stable climatic conditions, and even though water is supplied artificially by irrigation. How utterly absurd it is, then, to suppose that dry farming can be reduced to a definite system. Dry farming must, from its very nature, be carried on under the most critical climatic conditions, particularly as to precipitation; otherwise, it would not be dry farming in the sense that this term is now generally used on the Great Plains east of the Rocky Mountains. It may be that the conditions there are even more unstable and critical than in other dry-farming districts. But it is in that area that dry farming is now being most extensively developed, and it is therefore with these conditions that the writer will deal.

RANGE OF PRECIPITATION.

Within the area specified annual precipitation at a given station may easily range during a term of years from as low as 10 to as high as 30 inches; for the six growing months from as low as 5 to as high as 20 inches; during the six dormant months from less than 1 to more than 10 inches, and for the month of June from less than 1 to more than 8 inches. It is not an unusual occurrence to have a single torrential downpour of rain which exceeds in amount the normal precipitation for the month in which it occurs. These torrential rains frequently come with such force as to puddle the soil surface, thus making it impervious to water and resulting in the utilization of but a small percentage of the precipitation. On the other hand, showers of less than half an inch do very little good, as the water generally evaporates from the surface without penetrating sufficiently to be of any use to growing plants or to add to the water being stored in the soil. Briggs and Belz[1] show that as

[1] Bulletin 188, Bureau of Plant Industry, entitled "Dry Farming in Relation to Rainfall and Evaporation," p. 15.

high as 80 per cent of a rainfall of 2.5 inches falling in 4 hours on nearly level summer-fallowed land was lost by run-off, while a monthly precipitation of 1.9 inches which came in nine light showers was of no practical value, as it all evaporated before penetrating the surface mulch. From this it will be readily seen that the available precipitation is even more precarious and erratic than is indicated by the monthly, seasonal, or annual weather records.

TEMPERATURE AND LENGTH OF SEASON.

The ranges of temperature in the Great Plains are hardly less erratic than those of precipitation. In the northern part of the area, at Glendive, Mont., the absolute minimum was —47° F. for February and the absolute maximum 117° F. for July, 1893, a range of 164 degrees. The latest killing frost in spring at the same station was on June 9 and the earliest killing frost in the fall on September 11, leaving a frostless period of only three months. In central Texas, at the southern end of the Great Plains area, the absolute maximum is 110° F., and the absolute minimum —6° F., a range of 116 degrees. The latest killing frost in the spring usually occurs in central Texas about the middle of March and the earliest killing frost about the middle of November, a period of eight months.

SHORT SEASONS A RESTRICTION TO CROPS.

In the extreme southern portion of the Great Plains area the season is long enough for the successful growth of cotton, while in the extreme northern portion the season is too short for the growth of corn for grain production. In the northern part of the area but a single crop can be grown upon the land during any one season and the time of seeding and harvesting that crop is confined within exceedingly narrow limits, while in the southern portion two or more crops may follow each other upon the same land, or, if but a single crop is grown, the time of seeding may vary through a range of several months. In the northern portion the ground is continuously frozen to a depth of several feet for about six months of the year, while in the southern portion it is frozen to but a slight depth and only for short periods during the winter.

EFFECTS OF EVAPORATION, HAIL, AND HOT WINDS.

Evaporation is much more rapid in the southern than in the northern portion of the Great Plains. Hailstorms are common throughout the entire area. Hot winds are experienced everywhere, except, possibly, in parts of Montana and Wyoming. While hail and hot winds are about equally destructive in any part of the area, the possibility of raising a second crop during the same season on land where the first crop has been destroyed by either of these causes is confined to the southern half of the region.

DIVERSITY OF SOILS.

The soils of the area may be roughly classified into two great groups. The first group, which is the larger, includes soils ranging from the heaviest clay to light alluvial loam, absorbing water slowly and subject to high percentages of run-off, particularly during torrential rains. The soils of the second group, ranging from coarse gravel to fine sand, absorb the heaviest rainfall readily, but have a low water-holding capacity. These soils vary in depth from a few inches to many feet.

FAVORED LOCALITIES.

While it is true that a large portion of agricultural land in the Great Plains consists of level or gently rolling upland plains, or benches, it is equally true that there are many thousands of acres of land within this area that present far more favorable conditions for farming than do these typical upland plains. These favorable conditions may be produced by a great variety of causes, among which may be mentioned the following: Partially subirrigated or occasionally inundated creek or river bottoms or valleys; sheltered coves or broad valleys along the foothills which receive the run-off from large areas of untilled land lying above them and which on account of altitude, exposure, and proximity to the foothills or mountains receive more rainfall than the adjacent plains; low-lying lands that receive the slow seepage from adjacent sand hills, which lie like enormous sponges upon the comparatively impervious heavier plains formations, quickly absorbing and slowly but steadily yielding up to these lower lying lands a very large part of all the rains that fall upon them. These and many other local influences tend to produce especially favorable agricultural conditions. It is in these favored spots that some of the most successful farms are found, and it is upon the results here obtained that many of the reports of successful dry-land farming are based. In many instances these results have no more direct relation to what may reasonably be expected from a typical upland prairie farm on the open plains in the dry-land region than have those obtained upon some farm in Iowa or eastern Nebraska.

FAVORABLE SEASONS.

Then, again, the results obtained during a particularly favorable season on a typical dry-land farm may be equally misleading. A practice which might be very successful in the southern portion of the Great Plains area might be very objectionable in the northern portion, or vice versa; or a practice which would bring good results on one type of soil in a given locality on a typical farm in a normal year might fail entirely upon a different type of soil on the same farm during the same season. These facts are self-evident and are recognized by everyone who has a broad and comprehensive knowledge of the agricultural conditions in the Great Plains, and they should be known by all who contemplate settling in that region. If they were constantly kept in mind and logically considered, there would be an end to the broad generalizations which have done so much to mislead the public concerning the nature of the agricultural problems in the Great Plains and the methods of their solution.

SELF-RELIANCE OF DRY-LAND FARMERS.

It is practically useless to attempt to lay down any hard and fast rules for the guidance of the dry-land farmer. All the help he can hope to obtain from outside his own experience is a better understanding of some of the general principles involved in the production of crops under semiarid conditions. For the application of these principles he must rely almost entirely upon his own judgment, experience, and powers of observation. Anything which tends to lessen his self-reliance and leads him to hope that someone else can lay down rules for him to follow is a step in the wrong direction. The work yet to be done in the agricultural conquest of the semiarid West is pioneer work of the most strenuous kind. It is no task for weaklings, either physical, intellectual, or moral. An authority [1] on this subject has very truly said:

> From the ninety-eighth meridian west to the Rocky Mountains there is a stretch of country whose history is filled with more tragedy and whose future is pregnant with greater promise than perhaps any other equal expanse of territory within the confines of the Western Hemisphere.

KIND OF ASSISTANCE NEEDED.

It should be our purpose to assist in the fulfillment of the promise mentioned and to guard against a repetition of the tragedy. Any assumption of knowledge which we do not possess, any withholding of disagreeable facts concerning the difficulties to be encountered and overcome, or any magnifying of the rewards to be gained will tend to defeat this purpose. This undertaking calls for men possessing the same sterling qualities of self-reliance, initiative, and ability to meet and overcome new and unforeseen difficulties which have always been characteristics of the successful pioneer. Any form of paternalism which fails to take into consideration these traits of character in the

[1] Simons, A. M. The American Farmer, p. 54.

farmers of this region will be resented by those who possess these characteristics and will prove ineffectual to help those who do not. These farmers need all the assistance that the United States Department of Agriculture and the State agricultural colleges and experiment stations can give them in their agricultural conquest of the semiarid lands, but this assistance should be in establishing principles rather than in teaching practices. There is much yet to be learned concerning some of the most fundamental principles of dry-land agriculture which can be learned only by systematic, long-continued investigations at many stations located in different parts of the area upon different types of soil and under different climatic conditions.

THEORIES OF TILLAGE.

Much has been written upon the question of the proper tillage for the preparation of the soil for a seed bed, for instance, but what do we really know about it? It is fairly well agreed that three things are necessary: (1) A fine, moist, mellow, but somewhat compact seed bed of a depth sufficient to afford the best conditions for the germination and early growth of the seed; (2) a receptive condition of the soil, so that the rains falling upon the surface may be absorbed as rapidly and as completely as possible; and (3) a retentive condition of the soil, so that the water which is absorbed may be held within the soil for the use of the crops instead of being evaporated from the surface. Thus far we are on comparatively safe ground, but when we attempt to go one step further and ascertain from a consultation of the literature of the subject how these desirable conditions of the soil are to be produced and retained we encounter a maze of conflicting theories and generalizations, all based upon far too limited observation, experience, and experimentation. Some writers insist that relatively shallow plowing—never to exceed 7 inches—packing with a subsurface packer, alternate cropping and summer tillage, and the maintenance of a dust mulch at all times when the land is not covered with a growing crop is the one and only way, while others are equally certain that deep plowing—10 inches or more—will solve all the difficulties and allow the growing of a crop every year. Between these two extremes is to be found every grade of modification, and the only feature that nearly all of these writers have in common is the insistence that their particular "system" is the only one that will meet all requirements.

It is gratifying to find occasionally a sane and conservative article upon this subject, such as an address delivered by Hon. W. R. Motherwell, Minister of Agriculture for Saskatchewan, Canada, at the Fifth Dry-Farming Congress, held at Spokane, Wash., October 3 to 6, 1910. Mr. Motherwell said:

Some authorities have undertaken to lay down a hard and fast rule with regard to the best method of tillage to pursue under semiarid conditions, but so far as Saskatchewan is concerned such rigidity applied to our varying soil, altitude, exposure, precipitation, and climatic conditions would only lead to loss and disappointment. Variations in method must and can be pursued without departing from principles, and herein lies the importance of every farmer understanding something of the science of soil physics in order to have the ability to prescribe such crops and tillage methods as will meet the requirements of his particular farm, just as a physician prescribes to suit the individuality of his patient.

If these statements are true, as they unquestionably are, for Saskatchewan with its comparatively narrow range of soil and climatic conditions, how much more important is it to observe the same conservatism in treating of the Great Plains area of the United States, where this range is far greater.

SUMMER-FALLOWING TOO EXTRAVAGANT A SYSTEM.

Nowhere else east of the Rocky Mountains has the practice of summer-fallowing been so generally practiced as in Saskatchewan. Mr. Motherwell calls it "the very foundation stone of successful agriculture in Saskatchewan." This is due largely to the short seasons and the impracticability of raising corn or other intertilled crops as extensively as the small grains. In discussing the subject, Mr. Motherwell says:

But with the passing of time, cheap land, root fiber, and humus, many advanced and thinking farmers are now searching for a more economic, permanent, and less extravagant system of farming. * * * Furthermore, this system, while restoring nothing to the soil, rapidly dissipates its humus and thus, as the years go by, reduces its capacity to absorb and retain moisture.

DEEP PLOWING NOT GENERALLY ADVISABLE.

In discussing the subject of deep plowing Mr. Motherwell says:

Too much indiscriminate advice to plow deeply under all circumstances in Saskatchewan would be unwise and misleading, and must meet with disappointing results, but that all clay soils should be stirred deeply at least once after being broken up is becoming more and more apparent. Deep plowing, to increase the soil's capacity to store moisture, at intervals of say 10 or 12 years, to be followed by shallow plowing or surface tillage in intervening years, to hasten maturity, is now thought to be the ideal method in many localities. The danger of too frequent deep plowing is obvious.

It is not the desire of the writer to attempt to show that Mr. Motherwell is opposed to either summer tillage or deep plowing, for he is a strong advocate of both *under certain conditions* which commonly occur in Saskatchewan, as is fully set forth in the article from which these quotations are made. The purpose of these quotations is solely to show the eminently sane and scientific attitude of mind of this authority, which is in strong contrast to that of most writers and speakers who discuss this subject. It is very unfortunate that it is often only the extravagant and sensational utterances which reach wide publicity in the press, while sane and conservative papers attract little or no attention.

NO INVARIABLE RULE FOR PREPARING THE SEED BED.

Coming back to a consideration of the means to be adopted to secure the three essentials of a good seed bed—i. e., (1) a favorable medium for germination and early growth of the root system, (2) receptivity to rain water, and (3) retentivity of soil water—it is a well-established fact that upon some soils under some climatic conditions and for some crops all of these conditions can be met by a thorough disking, with plowing only in alternate years. This method is particularly applicable to fitting corn stubble for a crop of small grain, either fall or spring sown. In many instances shallow spring plowing gives better results than early deep fall plowing where one small-grain crop follows another. Subsoiling has failed to give any increased yield in many instances where it has been tried as a preparation for corn, wheat, oats, or barley. Sometimes it has proved injurious, and in only a few instances has it increased the yield sufficiently to warrant the additional expense. Summer-fallowing has very generally increased the yields of spring-sown wheat, oats, and barley, but this increase has seldom been sufficient to warrant the practice. On the other hand, it has very frequently reduced the yield of corn. The most thorough summer tillage has failed utterly to produce any crop in several instances when the drought was very severe and extended over two consecutive seasons, notably at Bellefourchè, S. Dak., and at Garden, Kans., during the season of 1911. The above statements are based upon carefully conducted experiments at many stations throughout the Great Plains, as described in Bulletin No. 187 of the Bureau of Plant Industry, which contains tentative conclusions which have since been confirmed by two years' additional results.

DEEP PLOWING MAY NOT INCREASE THE WATER-HOLDING CAPACITY.

Perhaps one of the most common fallacies is that deep plowing invariably and necessarily increases the water-holding capacity of the soil. Our investigations show that in many instances the receptivity of the soil is governed entirely by the physical condition of the upper 4 or 5 inches, the undisturbed subsoil being of such a nature over very considerable portions of the Great Plains that it is able to transport downward by capillarity all the moisture absorbed by the surface layer of soil as rapidly as it is accumulated in that layer. Under such circumstances there would manifestly be no increase in either the receptivity or water-holding capacity of the soil if the plowing were deeper than 4 or 5 inches. Whether this rule will apply to any given soil can be determined only by careful observation, which should extend over a sufficient period of time to include a considerable range of climatic conditions and particularly the varying degrees of intensity and duration of rainfall.

ROOTS EXTEND DEEP INTO SUBSOIL.

Our knowledge of the root development of ordinary crop plants under dry-farming conditions is inadequate, but from all that is known on the subject we have good reason to believe that in order to produce even an ordinary yield of any cereal crop the root system must penetrate several feet into the undisturbed subsoil. Considerable attention was attracted at the Sixth Dry-Farming Congress, at Colorado Springs, Colo., by photographs of the root system of a stool of wheat grown near Burns, Wyo., which showed a penetration of the roots to a depth of 6 feet. There is no reason for supposing that there is anything unusual about this particular stool except that it was washed out so as to show its development. Assuming that the land was plowed to a depth of 6 inches, then eleven-twelfths of the root system was developed in the undisturbed subsoil. It is altogether probable that this represents a normal development of dry-land grains. If such is the case it will be seen that a difference of 4 or 5 inches in the depth of plowing would represent so small a fraction of the depth of the root system as to be practically negligible.

CROPS DEPEND MAINLY UPON SUBSOIL.

It is an open question, even, whether after the seed has germinated and the roots have developed for a few inches the undisturbed subsoil may not furnish a more congenial medium for root development and food supply than does the tilled surface layer. Whether this is the case or not it is manifestly impracticable to till the soil to a depth sufficient to represent any considerable portion of the depth reached by the root system. We must therefore depend mainly upon the undisturbed subsoil to produce our crops. There is still much to be learned concerning the whole problem of root development under dry-land conditions, but it seems probable that a recognition of some fairly well-established facts concerning the great depth to which roots develop will profoundly modify some of the present theories and practices of tillage.

THE SCIENTIST ESTABLISHES PRINCIPLES, THE FARMER APPLIES THEM.

Dry farming offers an unlimited field for careful, honest, scientific investigation, and such investigations will ultimately establish some important principles of physics and plant physiology which are now only dimly recognized or entirely unknown. If the press of the country would make an earnest effort to teach the general public, and particularly the farmers, that the primary function of the United States Department of Agriculture and the State agricultural colleges and experiment stations is to establish principles rather than to teach practices and that the farmers must rely largely upon their own judgment and experience to apply these principles, it could accomplish much good for all branches of agriculture.

CONCLUSIONS.

In conclusion, the following misconceptions concerning dry farming may be mentioned as among the most serious: (1) That any definite "system" of dry farming has been or is likely to be established that will be of general applicability to all or any considerable part of the Great Plains area; (2) that any hard and fast rules can be adopted to govern the methods of tillage or of time and depth of plowing; (3) that deep tillage invariably and necessarily increases the water-holding capacity of the soil or facilitates root development; (4) that alternate cropping and summer tillage can be relied upon as a safe basis for a permanent agriculture or that it will invariably overcome the effects of severe and long-continued droughts; and (5) that the farmer can be taught by given rules how to operate a dry-land farm.

TREE PLANTING BY FARMERS.

By C. R. Tillotson,
Forest Assistant, Forest Service.

THE PRACTICE AND PURPOSE OF TREE PLANTING.

Farmers are responsible for nearly 90 per cent of the approximately 1,000,000 acres of forest plantations in the United States to-day. Of these million acres, 860,000 are found in what is known as the central treeless region, which includes the States of Illinois, Iowa, North Dakota, South Dakota, Nebraska, Kansas, the prairie district of Minnesota, and those portions of Oklahoma and Texas lying west of the hardwood belt; while 100,000 acres are found east of it, and 40,000 acres west. In the older settled portion of the treeless region of Illinois, Iowa, Nebraska, Kansas, and eastern Minnesota the area of planted timber is on the decrease. Plantations of such rapid-growing species as white willow, soft maple, and common cottonwood, established 30 or 40 years ago chiefly for protection from winds, are now being cut, because they are mature and for the most part are situated on land which is more valuable for agriculture than for the production of timber of low value. Because, in fact, most of the land in the States last mentioned has a high value for agriculture, future planting in this region is likely to be confined to the establishment of narrow belts of some coniferous tree for the protection of farm buildings or to the production of timber from some such rapid-growing species as hardy catalpa.

In the other portions of this treeless region planting is on the increase, chiefly for the purpose of protection, but partly, also, for the production of fence posts.

East of the treeless region forest planting is also on the increase. Here this is due to a number of reasons, among them the decrease in the supply of native timber, the fact that considerable areas are more suitable for timber than for agricultural crops, and the expectation of quick and large returns from such trees as hardy catalpa and black locust. For these same reasons planting in this region may be expected to increase in the future. In a number of States planting is also being stimulated by competent State forest officers and, in addition, in Ohio, Massachusetts, Connecticut, New York, Maryland, and Vermont, through distribution by the State of forest-tree seedlings.

West of the treeless region planting for future protection in irrigated districts and for timber production in those parts of California adapted to the growing of eucalyptus will undoubtedly increase.

The aim of every farmer is to plant his ground to the crop which will bring him the best returns. Under ordinary conditions, on good agricultural soil, farm crops are, of course, the most profitable to plant. On many farms, however, there are one or more pieces of land which will return a greater profit under trees than under any other crop. This may be some area which, because of its being cut off by a railroad or stream, is not easily accessible; or some small corner which the owner does not think worth the trouble of working; or it may be a poor, sandy, or worn-out area which gives only small returns when planted to agricultural crops. Such areas should be planted to trees which are adapted to the site. If the soil is a good, well-drained loam some one of the more valuable, rapid-growing species which requires the best soil may be planted. If, on the other hand, the soil is poor, it may be necessary to plant a less rapid-growing species, but one which is best adapted to the site. In starting a forest plantation it is unnecessary to choose for the planting site the best soil or the most accessible part of the farm. Trees, in fact, enable the farmer to utilize to advantage those portions of his farm which under agricultural crops do not yield a reasonable return on the investment.

The initial cost of establishing a forest plantation is not great, and, except to keep out fires, the trees do not need attention after the first two or three years. In themselves the trees are a source of protection to the farm buildings near which they are planted; they increase the value of the farm and their products are a source of considerable revenue to the owner. In a region subject to extremely cold winds during the winter a windbreak planted around the farm buildings and the feed yards will not only save the farmer many dollars in feed for his stock and in fuel for heating through the protection it affords, but will furnish fuel, posts, and farm timbers as well.

It seems certain that in future many farmers will be forced to raise their own timber for general farm use or else pay an almost prohibitive price for it. In some sections of the country the price of posts has doubled in the last 10 or 15 years and may be expected to double again in the next 10 or 15 years. This article discusses briefly, for the region east of Nebraska and north of Tennessee and North Carolina, the best trees to plant, the methods to be followed in planting them, and the products they yield. For convenience the larger region is subdivided into three smaller ones—the treeless region, which includes the States of Iowa and Illinois; the hardwood region, embracing Ohio, Indiana, Kentucky, and southern Michigan; and the northeast region, embracing Pennsylvania, New York, and the Northeastern States.

TREELESS REGION.

In the treeless region the soil favors the growth of a large number of species, among which are cottonwood, white willow, soft maple, green ash, hardy catalpa, black walnut, European larch, white and Scotch pines, and white and Norway spruces.

Of the hardwood groups, cottonwood grows most rapidly and does best on sandy bottom lands, where it reaches a height of from 75 to 80 feet and a diameter of from 14 to 15 inches in from 30 to 40 years. For its best development it should be spaced not more closely than 15 by 15 feet when planted in groves, or from 2 to 4 feet apart in a single row. In groves it should be filled in with silver maple to make a 7½ by 7½ foot spacing. It produces good lumber for inside dimension stuff.

Silver maple also grows rapidly. In groves, where it should be spaced about 6 by 8 feet, it reaches a diameter of from 8 to 9 inches and a height of from 65 to 70 feet in 40 years. Planted less thickly it will reach a diameter of from 12 to 13 inches in the same time. It thrives best on a good fresh loam, but has little value except for cordwood.

White willow makes a fairly efficient windbreak in a short time. It grows best on rather low, moist situations, but does well on less moist ones if the soil is good. In from 15 to 20 years it makes fairly good fence posts if the wood is well seasoned, and is also of value for fuel. White willow should be spaced about 6 by 6 feet.

Green ash has only a moderately fast growth. On good, well-drained soils it reaches a height of 45 feet and a diameter of 6 inches in 30 years. (Pl. XII.) It will grow on rather poor soil, but must have good drainage. On good black agricultural soil it is not commercially profitable, because agricultural crops would pay better on the land it would occupy. Its wood is valuable for handle material and for general use as a farm timber where strength is required. To insure straightness it should be planted as closely as 4 by 4 feet, or even more closely by sowing its seed broadcast.

Hardy catalpa grows rapidly on a fresh, well-drained, moderately heavy soil, or on sandy river bottom lands where the water table is close to the surface. On such soils it will reach a diameter of from 6 to 7 inches and a height of from 40 to 50 feet in 20 years. It is chiefly valuable as a fence-post timber, although it is somewhat utilized in the manufacture of tool handles. It should be spaced about 6 by 8 feet. Since it is liable to freeze back, it should not be planted farther north than central Iowa.

Black walnut grows slightly faster than green ash and produces straighter timber. At 30 years, on good, fairly heavy, well-drained soil, it reaches a diameter of from 6 to 7 inches and a height of from 45 to 50 feet, yet it is not of much value until it reaches an age of from 60 to 75 years, when it may be cut for lumber. It should be spaced about 4 by 8 or 6 by 6 feet. On good black soils it is not profitable, and on pure sands it will do nothing.

Of the conifers, European larch is fairly rapid growing and valuable for post and pole material. On good, well-drained loam, the soil it requires, it reaches a diameter of from 8 to 10 inches and a height of 50 feet in 30 years. In groves it should be spaced 10 by 10 or 12 by 12 feet, and filled in to 5 by 5 or 6 by 6 feet with a slightly slower growing, shade-enduring species such as white pine. Good straight material of a larger size is produced when planted 4 feet apart in single rows.

White pine does well in Iowa and should do well in northern Illinois. It reaches a diameter of from 8 to 10 inches and a height of from 55 to 65 feet in 40 years. It grows well on either a good, well-drained loam or on poor sand, and produces lumber of high quality. If planted in a pure stand it should be spaced 6 by 6 feet, but may be spaced 10 by 10 feet and filled in to a 5 by 5 foot spacing with Scotch pine.

Scotch pine is chiefly valuable for planting on poor sand where better trees will not thrive; in fact, it does better on sandy than on heavy soils. It is easily established and grows rapidly for the first 15 or 20 years, after which it falls off in its rate of growth and becomes crooked in the top. It reaches a diameter of from 6 to 9 inches and a height of from 40 to 55 feet in from 35 to 40 years. It is a good tree to plant in mixture with white pine.

White spruce is an excellent tree for windbreaks because, though it grows slowly, it is long lived and hardy, and may be utilized for lumber when mature. It will stand considerable moisture, but does best on well-drained loam. For windbreaks it should not be spaced more closely than 10 by 10 feet.

Norway spruce is also a good tree for windbreak purposes. It grows more rapidly than the white spruce, but is not so good for windbreaks because it is shorter lived and becomes rather ragged with old age. For windbreaks it should not be spaced more closely than 10 by 10 feet. It grows best on a fresh, well-drained loam or sandy loam, and very slowly on pure sand. It does not thrive in northwest Iowa. When mature it produces lumber of good quality.

HARDWOOD REGION.

In the hardwood region black walnut, white ash, and hardy catalpa grow well. In general, the conditions which are essential for the best growth of these species, and their rates of growth, are similar to those described for them in the treeless region. Black walnut grows well on the well-drained, strong clay loams or on rich dark sandy loams, but will do nothing on pure sand. Both white and green ash grow well on clay loams, and give promise for planting on worn-out clay-loam soils. While they will grow on light sandy soils they do not thrive there. Hardy catalpa does best on the well-drained black soils in these States, and fairly well on even the poorer yellow clay loam and gravelly loam soils, but can not be grown successfully on poor upland sandy soils. It is hardy as far north as southern Michigan, but is winter-killed in the central part of the southern peninsula.

The foregoing species represent only those which have been grown successfully in plantations in this region. There are a number of others which have not yet been given a thorough trial, but which promise well. Among these are the western yellow pine for gravelly clay soils, red oak for poor clay soils, yellow or tulip poplar for moist ravines or near stream courses, Scotch pine for the poorest sandy soils, and white pine for sandy gravelly loam or clay loam soils.

NORTHEAST REGION.

In the northeast region it is certain that white pine, red pine, Scotch pine, Norway spruce, European larch, and red oak can be grown in plantations.

White pine grows well on sandy or gravelly loams, and is especially adapted to worn-out agricultural or pasture lands. It is, however, subject to attack by the white pine weevil, which bores into and kills the leading terminal shoot. A new leader is usually formed from one of the side branches, but the resulting main stem is crooked and the value of the plantation seriously impaired. In localities where this insect is known to be a serious pest it is scarcely advisable to plant white pine when the owner's object is to produce merchantable timber.

Another menace to young white pine stock is the white pine blight or blister rust. This disease originated abroad, and is found mostly in young stock imported from Europe. It is best, therefore, for the planter to purchase trees grown in this country or else raise his own stock.

Red pine is especially suited to poor sandy or gravelly soils, and has the additional advantages of being hardy and not subject to serious injury by either insects or fungi. It reaches a height of 40 feet and a diameter of from 8 to 10 inches in from 35 to 40 years. (Pl. XIII.) It should be spaced 6 by 8 or 8 by 8 feet. Scotch pine, also, is particularly adapted to poorest sandy soils, grows rapidly at first, but, as in the other regions, falls off in growth and becomes crooked in the top as it grows older. On poor sandy soil it reaches a diameter of 7 inches and a height of 45 feet in 35 years. It is especially adapted for mixture with white pine. For the better, fresh soils of the upland region Norway spruce is a good tree. It will, however, grow on the poor, very sandy loam soils and reach a diameter of from 8 to 9 inches and a height of 55 feet in 35 years. (Pl. XIV.) It should be spaced 5 by 5 or 6 by 6 feet.

European larch does not promise much either in sandy or loamy soil. It may be better adapted to the high mountains, but this has not been proved. In this region the larch is subject to attack by a sawfly which defoliates and sometimes kills it.

Red oak has much to commend it. It can be planted cheaply, grows fairly rapidly either on poor heavy or poor sandy soils, reaches a diameter of 8 to 9 inches and a height of 45 feet in 35 years, and produces material of a high quality. When planted pure a spacing of 6 by 6 feet is close enough. Because of its ability to grow under partial shade, it is a valuable tree for underplanting old stands which have light crown cover.

In the foregoing discussion only those species have been mentioned which have been grown successfully in plantations in this region. Other trees which should do well are: Hardy catalpa on well-drained soils in the southern New England States; yellow poplar in moist situations in Pennsylvania, southern New York, and southern New England; black walnut and white ash on good soils in Pennsylvania, New York, and southern New England; and western yellow pine on the poor sandy or gravelly loam. It may seem surprising that black locust has not been mentioned in a discussion of the trees suitable for planting in these three regions. This tree is eminently suited for planting on poor sandy or clay soils, is hardy throughout the greater part of this territory, grows very rapidly, and produces posts and lumber of high value. It is, however, so subject to destruction by the locust borer before it reaches merchantable size that until some practical method of controlling this insect is devised its planting can not be recommended. It is also inadvisable to plant chestnut until a successful method is devised for controlling the chestnut bark disease, which is seriously threatening old stands throughout the northeast region.

SUCCESSFUL METHODS OF TREE PLANTING.

Thorough preparation of the soil by plowing and harrowing will many times pay for itself. Besides putting the soil in good tilth, it shortens planting operations, conserves soil moisture, helps to insure the establishment of the trees, and induces a rapid initial growth. In some situations, of course, such preparation is unnecessary, as on sand which does not support a heavy sod of grass; in others it is impossible except at prohibitive expense, as on steep slopes or in soil filled with rocks or large roots. Where the soil can not be prepared before planting, a small area surrounding the spot in which the seedling is to be planted should be cleared of the competing growth of grass.

The chief methods which may be successfully followed in planting operations are direct sowing of seed, planting in a furrow, digging a hole for each individual tree, and what is known as the slit method. Direct sowing on prepared ground is adapted to good loam soils in the treeless region with soft maple, green ash, black walnut, and butternut; in the central hardwood region, with red oak and black walnut; and in the northeast region with red, white, Scotch, and pitch pines, red oak, and black walnut. In direct sowing, the method generally followed is to plant a number of seed in regularly spaced spots throughout the planting area, and to cover them by hand. By planting several seed in each spot the growth there of one or more trees is practically insured. In the treeless region very good success at a very low cost has been obtained with green ash by sowing the seed broadcast on prepared ground and covering them by harrowing. Furrow planting is cheap and successful on good soil in the treeless and hardwood regions with willow, cottonwood, white pine, soft maple, and green and white ash. Digging a hole for each tree is good for all three regions and for all species. It is expensive, but in some situations, and everywhere when large trees are planted, it is the only method which can be used. The slit method, also, may be used in all regions, and for all species, though it is particularly adapted to soils of a loose texture, or to ground that has been prepared. It is rapid and comparatively inexpensive. It consists in opening a wedge-shaped hole in the ground by inserting a spade and moving it back and forth. The roots of the seedling are then inserted back of the spade in the hole thus formed, the spade is removed, and the earth is pressed firmly around the stock with the foot.

PLANTING-STOCK.

In choosing stock for planting, due consideration must be given to the planting site and to the care which will be given the trees after planting. One-year-old stock is old enough for such hardwood trees as ash, maple, and catalpa. Not only is it more likely to succeed than older stock, but it costs less and is cheaper to plant. For black walnut and oak the seed should be placed in the ground where the trees are to grow permanently.

If coniferous trees such as pine or spruce are to be planted, two-year-old seedlings or transplants or three-year-old transplants are about right. As with the hardwood stock, these younger, smaller trees cost less, are cheaper to plant, and in all but exceptional conditions are more likely to succeed than the older stock. Transplanted stock of coniferous trees two or three years old has a more fibrous and better developed root system than seedling stock and is more likely to succeed. On heavy soils, for instance, where cultivation can not be given after the plantation is started, as on a cut-over area filled with roots of the old trees or on a very steep slope, the young trees will be subjected to the competition of a heavy growth of grass, and transplant stock invariably should be used.

CULTIVATION.

Cultivation for two or three years after the plantation is started is desirable and almost necessary on the heavy soils of the treeless and hardwood regions. It keeps down the heavy growth of grass which almost invariably takes possession of these soils if they are left undisturbed, conserves the moisture, induces rapid initial growth, and hastens the formation of a crown cover.

On sand or in the northeast region on poor worn-out pastures or agricultural lands which do not support a heavy growth of grass, cultivation, while desirable, is not so necessary. On the better soils of this region, however, plantations of such trees as black walnut, white ash, and hardy catalpa must be cultivated if good growth is expected.

The most noticeable difference between cultivated and uncultivated plantations is that in the former the trees become well established during the first or second season and show good, vigorous height growth during these seasons, while in the latter the trees do not become well established until the end of four or five years and during that time make poor height growth.

The planter may wonder how much cultivation is necessary. During the first couple of years three or four cultivations should be given during each growing season, but during the third year two cultivations will suffice under ordinary conditions for all hardwood trees and for most conifers. The common two-horse cultivator is best until the trees become so large that they may break when bent over by it. After that it will be advisable to use a one-horse cultivator, working between the rows.

One thing to be remembered in cultivation is that it should not be continued too late in the season. Forest trees, like fruit trees, are subject to damage by early fall frosts, and if their wood is particularly succulent at the time when these occur the trees may be seriously injured. Late cultivation is conducive to this condition of the wood, and this operation should be discontinued between the 1st and the 15th of July. Grass or other vegetation which comes in after this time

GREEN ASH PLANTATION, ABOUT 40 YEARS OLD, ILLINOIS.

RED PINE PLANTATION, 33 YEARS OLD, RHODE ISLAND.

SPRUCE PLANTATION, 33 YEARS OLD, RHODE ISLAND.

[The soil is poor and sandy, but good care has produced excellent results.]

will serve a good purpose in drying out the soil and inducing early maturity of the trees and the hardening of their wood, thus enabling them to withstand the heavy frosts of fall and winter. Even such a hardy tree as the black walnut has been known to be killed back to the ground by severe early frosts and winters when cultivation was practiced until late in the growing season.

ADVISABILITY OF PRUNING.

With the majority of trees commonly found in forest plantations pruning is unnecessary and in some cases harmful. The greater number of species will, if left alone, prune themselves, and the products derived from the others are not of enough value to warrant the expense of pruning. Pruning is harmful in that it reduces the leaf surface or food-manufacturing part of the tree, which must result in a lesser rate of growth; and, further, excessive pruning of such trees as hardy catalpa, and green and white ash, is likely to result in top-heaviness, which may lead to their being broken off by the wind. A further danger in pruning lies in the fact that the operator may be unskilled in the work and in reality not know how it should be done. He is very likely to leave ragged wounds or stubs of branches, neither of which will heal over for a number of years, and in some cases not at all. These places form a ready opening through which fungi or rot may enter the tree and in time kill or injure it. Some trees whose products are of especially high value, or others whose branches are especially persistent, should be pruned of dead branches. The species which need pruning are white pine, hardy catalpa, and black walnut; those which do not need pruning are soft maple, green ash, Scotch pine, cottonwood, white ash, oaks, European larch, Norway pine, and Norway spruce. Black walnut needs pruning only occasionally when some dead limb threatens to cause the formation of a loose knot, though as a rule walnut prunes itself well. It is sometimes necessary to prune off living limbs of catalpa and of green and white ash in order to induce the development of a single straight leader. In the ashes the leading shoot is just as often developed from one of the lateral buds as from the terminal one, and it is sometimes desirable to prune off these lateral branches in order to induce vigorous growth of the terminal shoot and so prevent the formation of a crooked main stem. Catalpa forms no terminal bud, but ordinarily produces three branches from near the tip of the last year's growth. When all three of these grow about equally one or two of them should be pruned off so that the third will develop into a leader. In all cases the limbs should be cut off cleanly and close to the trunk, so that the wound may quickly heal over.

THE ADVISABILITY OF THINNINGS.

Every forest plantation reaches at some time, varying with the species, spacing, and soil, a condition when a number of the standing trees should be cut out. Owners of forest plantations are most likely to err in failing to make thinnings. Thinnings should be practiced when the presence of dead or dying trees in the stand, a very dense crown cover, or an apparent stagnation in the growth of the living trees indicates that they are needed. The chief object of a thinning is to give more space and light to the trees left standing, so that they may be stimulated to more active growth. This is accomplished by cutting out the dead, crooked, diseased, or otherwise undesirable trees, which, through overtopping or crowding the better, straighter trees of the stand, are retarding their rate of growth, or even killing some of them. It may be necessary to repeat this operation several times during the lifetime of the stand, depending principally upon the species. For most trees grown in plantations two to three thinnings will be sufficient. The time to thin is a matter which must be left to the judgment of the owner.

In thinning a considerable amount of material will be cut out which can be utilized for various farm purposes, such as fuel, posts, poles, or braces. Not only this, but the trees which are present in the stand at maturity will be larger, straighter, and of better quality in every way than those in similar even-aged plantations in which thinnings have never been made.

PRODUCTS AND RETURNS FROM PLANTATIONS.

The table on page 267 indicates the products which may be expected from forest plantations and the time which will be required to produce them. In addition to these products of the mature stand, it must be remembered that thinnings will yield other material, such as cordwood and posts, taken out of the plantation before it reaches maturity. No figures as to the monetary returns which may be expected from a plantation can be given; they will vary, of course, with the species, the kind of soil, the care given the plantation, and the value of the products at the time the trees are cut. There is no doubt, however, that some lands, even if planted to the slower growing species, will show returns equal to if not greater than those that can be secured from the growing of agricultural crops. Moreover, the values from timber crops will increase much more rapidly than those from agricultural crops, and the returns from plantations in the future may be expected to be greater than those from plantations in the past.

A word of warning to all prospective tree planters will not be amiss. It is just as unfortunate as it is true that when some tree is

Species and methods for planting in different regions, and products which may be obtained from plantations.

Species.	Region to which tree is suited.	Soil.	Spacing.	Planting method.	Products.	Age.
						Years.
Cottonwood	Treeless	Moist soil; sandy river bottom best.	15 by 15 feet; underplant with soft maple, or plant 2 to 4 feet apart in rows.	Plant cuttings in a furrow	Lumber and cordwood	30–40
Silver maple	do	Fresh to moist loam or sandy loam.	6 by 8 feet	Sow seed direct	Cordwood	25–40
White willow	do	do	6 by 6 feet	Plant cuttings in a furrow	Posts, cordwood	20
Green ash	Treeless, hardwood, northeast.	Well-drained loam soil	4 by 4 feet	Sow seed direct	Handle material, farm timbers.	40–50
White ash	do	Well-drained black or clay loam.	do	do	do	40–50
Hardy catalpa	Treeless, hardwood, south part of northeast.	Well-drained loam or sandy loam.	6 by 8 feet	Slit method	Posts	18–20
Black walnut	Treeless, hardwood, northeast.	do	6 by 6 feet	Sow seed direct	Lumber	50–75
Red oak	Hardwood, northeast	Sandy or clay soils	do	do	do	50
European larch	Treeless, hardwood	Well-drained loam or sandy loam.	12 by 12 feet; fill in to a 6 by 6 foot spacing with white pine.	Slit method	Poles, posts	25–40
White pine	Treeless, hardwood, northeast.	Well-drained sandy or loam soils.	6 by 6 feet	Slit or furrow method	Lumber	50
White spruce	Treeless, northeast	Fresh to moist loam	For windbreak 10 by 10 feet.	do	do	60
Norway spruce	Treeless, hardwood, northeast.	do	do	Slit method	do	50
Red pine	Treeless, northeast	Poor sandy or gravelly soils.	6 by 8 feet	Sow seed direct; dig hole for each tree; slit method.	do	50–60

particularly valuable for planting because of its hardiness, rapidity of growth, or durability, its qualities are grossly exaggerated by unscrupulous agents merely for the purpose of selling their stock. Credence should not be given to the exaggerated claims of these men. Some have said, for instance, that fence posts may be grown in three years, and that enormous financial profits may be secured through the planting of the particular tree which they are attempting to sell. The State forest officers, in those States which have such officers, and those of the Forest Service of the United States Department of Agriculture are always glad to furnish information to any prospective planter about the rates of growth and other qualities or characteristics of any of the forest trees. If planters will take advantage of these opportunities for consultation, they will, in many cases, be saved time, money, and disappointment.

SEASONAL DISTRIBUTION OF LABOR ON THE FARM.

By W. J. SPILLMAN,
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LACK OF DEFINITE CROPPING SYSTEMS.

CHANGING CONDITIONS IN BOTH THE EAST AND THE WEST.

The number of farms in this country on which an attempt is made to follow a definite cropping system is extremely small. Even those farmers who do have in mind such a system as an ideal which they try to follow are frequently not able to do so. The reasons for this condition of affairs are numerous. In the first place, from the standpoint of the material development of the country we are yet a comparatively young nation. We are just reaching the end of the period of settlement in the newer parts of the country; the abundance of free land in the West has hitherto held back the development of permanent systems of agriculture in the East by taking away from the Eastern States the young men who would otherwise become farmers there. In addition to this, the tremendous growth of our cities, both east and west, and the development of efficient and cheap means of transportation are continually bringing about local changes in the prices of farm products, as well as in the facilities for marketing these products. In many localities systems of farming that developed two generations ago and that were well adapted to conditions which then obtained still exist under conditions that are not suited to them.

CONDITIONS IN NEW ENGLAND.

The older types of dairy farming in New England illustrate this fact. When hay was worth $6 a ton and bran $8 to $10 a ton, butter making on the farm, or, better, the marketing of milk at the creamery or cheese factory, was a very satisfactory type of farming. But the farmer can now sell his hay at $15 to $18 a ton and bran costs about $32 a ton. The increase in the price which the farmer receives for dairy products has not kept pace with the increase in the value of feeding stuffs. Thus, many New England farmers would find it more profitable to grow hay for the market than to keep dairy cows. A strong force, therefore, tends to change one of the commonest types of farming in New England for types which farmers generally have not regarded as feasible, and this change is gradually taking place.

CONDITIONS IN THE WESTERN STATES.

On the other hand, the low price of hay in the Western and central Western States and the relatively lower price of grain and mill products, coupled with the fact that dairy products have increased in price to a certain extent in recent years, calls for an increase in dairying in that region and a decrease in the production of market hay. Similar situations exist in other sections. For instance, a few years ago alfalfa hay sold at the farm for $3.50 to $4 a ton in many western localities. The development of the alfalfa-meal business has increased the demand for alfalfa to such an extent that it now sells readily at prices two or three times as high as formerly. The reason for this is that freight rates to the East are much less on alfalfa meal than on alfalfa hay. Hence, the meal can be sent to distant markets where it does not pay to ship the hay. When the price of hay was low, sugar beets were a more profitable crop than hay and the sugar-beet business developed on a large scale in some of the Western States. Now the situation is reversed. Alfalfa is more profitable than beets in many localities and requires much less labor. The labor is also better distributed through the season. As a result sugar-beet production is giving way in these localities to alfalfa growing.

RELATION OF CROPPING SYSTEMS TO THE SEASONAL DISTRIBUTION OF FARM WORK.

Similar changes in conditions over nearly all the country are causing changes in farm methods and in the types of farming followed. Changes in cropping systems bring about a different distribution of labor during the season. It takes several years to adapt a new type of farming to a new environment and to work out the many new problems in management which a new system presents. Hence it is that the American farmer has seldom solved the problem of distributing his labor through the year in such a way as to have it profitably occupied at all seasons.

FAILURE OF CLOVER AND TIMOTHY SEEDING.

Another reason why regular cropping systems are so seldom found is the fact that clover and timothy occupy so important a place in the agriculture of a large section of the country, and these crops, with their minute seeds, are very uncertain. The seeding frequently fails and this breaks up the rotation. Many farmers who have attempted to follow a rotation have abandoned the effort because of the uncertainty of securing a good seeding of timothy and clover.

CROPS THAT COMPETE FOR LABOR.

Those mentioned are only a few of the causes which contribute to the aimless and unsystematic methods prevailing on a large majority of American farms. It is probable that the lack of regular rotations is partly due to the fact that some of the most important crops of the country, of which most rotations would naturally consist, compete strongly with one another in the matter of labor required at certain seasons of the year. For instance, in central latitudes the cultivation of corn is still in progress when wheat harvest begins, and timothy and clover, the principal hay crops of the country, demand much labor almost simultaneously with wheat as well as with oats. This makes it necessary to lay by the corn long before the proper season and requires an enormous amount of work during the latter part of June and the early part of July, but leaves the latter part of the summer poorly occupied. This renders necessary the hiring of extra labor in June and July, while at some seasons there is not enough work to keep regular labor profitably employed.

One of the hardest problems the farmer has to face is that of labor. Reliable labor can not always be had even under the best of conditions. Where the cropping system is such as to require an excess of labor at one season and little or no labor at other seasons it is necessary to depend on transient labor, which is almost always of an undesirable character. In the North, where field work is precluded for a considerable portion of the year because of the long winter season, the problem of finding employment for labor the year round has led to the extensive development of winter feeding and winter dairying. The winter feeding of beef cattle and sheep is particularly adapted to this purpose. Dairying solves the problem as far as the winter season is concerned, but it also consumes time in summer when field work is abundant and therefore does not balance up the work of the year quite as well as winter feeding does, though in many cases it may be more profitable.

FILLING GAPS IN THE LABOR SCHEDULE.

INTERMITTENT EMPLOYMENTS.

Many farmers have developed some form of employment as an adjunct to their farming operations in order to give regular employment to their labor and thus be able to keep on hand dependable men when they are needed on the farm. One farmer has a stone quarry which is worked only when the labor on the farm is not sufficient to give employment to the men. Other farmers make brooms in the winter and at odd times at other seasons.

BETTER PLANNED CROPPING SYSTEMS.

In middle latitudes and in the South it is possible to plan cropping systems that will give regular employment to labor without these side industries. In this manner the area of land which one man or any definite number of men can farm is greatly increased. This means a larger yearly income per individual employed. Even if a crop grown returns a very small profit, if the work it demands comes at a season when the farmer would otherwise be idle, it adds just so much to the farm income without appreciably increasing the expenses. This point is well brought out in the agricultural surveys made by Cornell University in New York, as well as in similar surveys made by the Office of Farm Management in several States. It has been observed in these surveys that, other things being equal, those farms which have the largest variety of products to sell are the most profitable. The main reason for this is that these farms have a variety of interests that permit the farmer and his family and his hired labor to find profitable employment at all seasons of the year, while on farms with less varied interests there are frequently periods when there is no profitable employment.

EXCEPTIONAL CONDITIONS.

There are certain conditions which justify the farmer in disregarding the distribution of labor in planning a system of management. Some of the more important of these are here briefly discussed.

When the farmer conducts some other industry in which the labor may well be intermittent, such as quarrying, making boxes, mixing fertilizers, grinding agricultural lime, making brooms, clearing land, cutting railroad ties, and the like, he may well devote his land to those crops which are most profitable, with little or no regard to the labor requirements of these crops at different seasons of the year. In planning such a system he must, however, take into account the cost of keeping idle horses. He must also plan a system of soil management that takes account of the future productivity of his land.

There are also a few localities where labor is easily obtained when wanted. In such cases it is wise to devote the land simply to those crops that pay the best profit, provided a proper system of soil management is adopted.

In certain localities it happens that a particular crop is enormously more profitable than any other. This may happen when the area of land adapted to this crop is less than sufficient to meet the demand;

or it may be that a particular soil type produces a vastly better quality of product than other soils. In such cases it may be advantageous to devote the land exclusively to a single crop, or as nearly so as the exigencies of good soil management will permit. Under such circumstances the high profit from the crop may enable the farmer to pay wages that will secure labor when he needs it.

Again, a farmer may own only an area which he and his family can work in the crop which is most profitable in the locality, even when most of the labor on this crop comes during a short period of the year. In such cases he is justified in following a system that permits the largest use of the one or two most profitable crops consistent with good soil management, seeking outside employment at other seasons.

DESIRABILITY OF STEADY EMPLOYMENT.

Conditions such as those just referred to, when we consider the agriculture of the country as a whole, are exceptional, so that, speaking in a general way, a system of farm management which calls for approximately the same amount of labor at all seasons of the year not only greatly increases the area which a given force can farm, but, in many cases at least, increases the income of the farmer in approximately the same proportion. Hence, under most conditions it is wise for the farmer to follow a system that will give his labor permanent employment. There are instances where farmers deliberately grow crops that are not profitable in order to keep their labor employed so that they will be at hand when needed on crops that are profitable, and this course appears to be justifiable under certain conditions.

There are a few crops, such as cotton, and alfalfa in certain sections, that of themselves furnish employment during nearly the whole year. This is one of the reasons why the single-crop cotton-growing system has been able to persist indefinitely in our Southern States. But even in the case of cotton a farmer can grow some winter hay and other crops to a considerable extent without decreasing the acreage of cotton he can manage, and thus increase considerably the area of land he can farm properly, as well as his annual income.

PROBLEMS INVOLVED IN SEASONAL DISTRIBUTION.

So to plan the work of a farm as to distribute the labor equally throughout the year is no small task. The difficulty of doing so is attested by the small number of farms on which this task has been accomplished. The difficulty is increased by the irregularity of the seasons. In any case, the best that can be done is to make plans that are suited to a normal season and adjust them from time to time as the exigencies of the weather may require.

DATA NECESSARY.

In order to formulate a cropping system that will give a satisfactory distribution of labor during the season when field work is practicable, a wide acquaintance with crops and a knowledge of the dates of planting, tilling, harvesting, and all other operations connected with each crop are required. One must also know the amount of labor required for each of these operations, the number of men that must work together to accomplish the work economically, as well as the average percentage of days available for field work at different seasons of the year. If the work schedule is to include the care of live stock it is also necessary to know the amount of labor required for the various kinds of work as well as the seasons at which this labor must be performed.

These questions are of fundamental importance in farm management, and our information concerning them is as yet very meager. Considerable information of this character is accumulating in institutions which devote attention to the subject of farm management, but very little of it has yet been made available for use. Occasionally one finds a farmer who has followed a system of farming long enough and has observed with sufficient care to enable him to know in advance just how much labor will be required during every part of the coming season. It is very seldom, however, that such a farmer has succeeded in filling in all the gaps during the season, so that on the vast majority of farms there are times when the need of labor is greater than the supply, while at other times little or nothing is to be done except the daily chores.

DATA AVAILABLE.

Information is not at hand for dealing with all phases of the work of a farm. Even if it were, so many unforeseen accidents interrupt the regular farm work, often bringing unexpected demands for time and labor, that it would not be possible to follow blindly any work schedule outlined in advance. At the same time it is possible to outline a plan that will serve well as a guide in the management of the farm. A little attention to this subject serves to show that the area which a given force can farm when the work is thoroughly systemized is very much greater than is generally supposed. This paper will deal only with the cropping system. However, the Office of Farm Management is rapidly accumulating data that will, when available, permit the consideration of the whole system of management. These data will not only show the amount of labor and equipment required in the management of a given farm with a given system of farming, but will also show the margin of safety which must be left in order to meet all ordinary exigencies that arise in the course of the year.

This margin is determined by actual experience on a large number of farms from which detailed records are being compiled of all the work of every description done during a period of years.

Let us first examine the distribution of labor on a number of farms, in so far as this labor has to do with the cropping system.

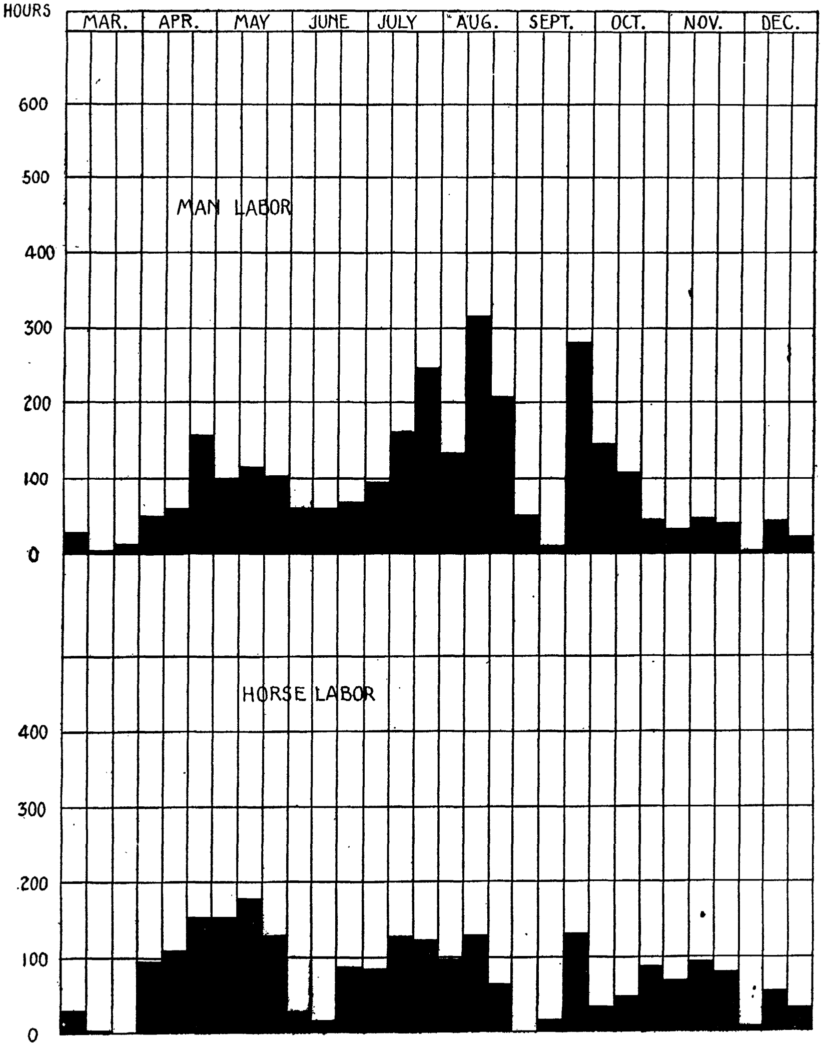

Fig. 3.—Distribution of field labor on field crops on a New England dairy farm. Crops grown: Corn, 11.35 acres; peas and oats, 14.20 acres; hay, 33.62 acres; potatoes, 1.69 acres; orchard, 2.91 acres.

EXAMPLE OF A NEW ENGLAND DAIRY FARM.

Figure 3 shows graphically the amount of labor of man and horse in connection with crop production on a New England dairy farm. This text figure and the three following figures have been prepared from actual records in the Office of Farm Management. These records show also the work done in other departments of these farms, but the complete records are to be discussed in later publications. Figure 1 shows three periods of the year in which the demand for labor is high, with intervening periods when the fields require very little labor. The periods of high demand are (1) the early spring (seed time), which makes the largest demand of all for horse labor; (2) the haying season, in midsummer, which demands the most man labor; and (3) the harvest and seeding period in the fall, which for a short period demands a large amount of labor of both man and beast. Only lack of space prevents giving in detail the labor by crops in figures 3 to 6. The detailed records of this farm show that oats and peas do not compete strongly with silage corn in the matter of dates when the work on these crops must be done. Yet a large acreage of oats and peas would limit the area of corn land that could be prepared for seeding in the spring. Hay harvest interferes considerably with the cultivation of corn. Two of the cornfields are given only two cultivations each because of this fact. Potatoes compete rather strongly with corn. Singularly enough, the orchard fits into this system fairly well; only the spring plowing interferes with any other crop.

It would be possible to fill the gaps in this system (fig. 3) and render the demand for labor approximately the same from April to October, inclusive, by the insertion of small acreages of certain truck crops. But since none of the farms from which records are available have done this and information is not at hand concerning the labor requirements and the particular times when this labor must be performed, this can not be done at present. It is clear, however, that if this were done it would considerably increase the income of this farm by giving the farmer and his family profitable employment for a longer period.

In contemplating this subject one can not help thinking that if some of the industries which in this country are now concentrated in large factories, where frequently the laborers are compelled to live under slum conditions, could be distributed and conducted, in part at least, in farm homes, as was the case before the days of the factories, it would not only help the farmer to solve his problem of profitable employment at all seasons, but would enable many of those who now spend their lives cooped up in the factories or in hovels with very insanitary and cheerless surroundings to live under more sanitary conditions and have at least wholesome food and good lodgings.

EXAMPLE OF A NEW YORK POTATO AND BEAN FARM.

Figure 4 shows the distribution by 10-day periods of the labor on field crops on a potato and bean farm in the State of New York. The distribution of man labor on this farm is particularly irregular. During the last two-thirds of August there is practically nothing to do. The potatoes and beans have been laid by and it is not yet harvest time. The large amount of labor during the latter part of

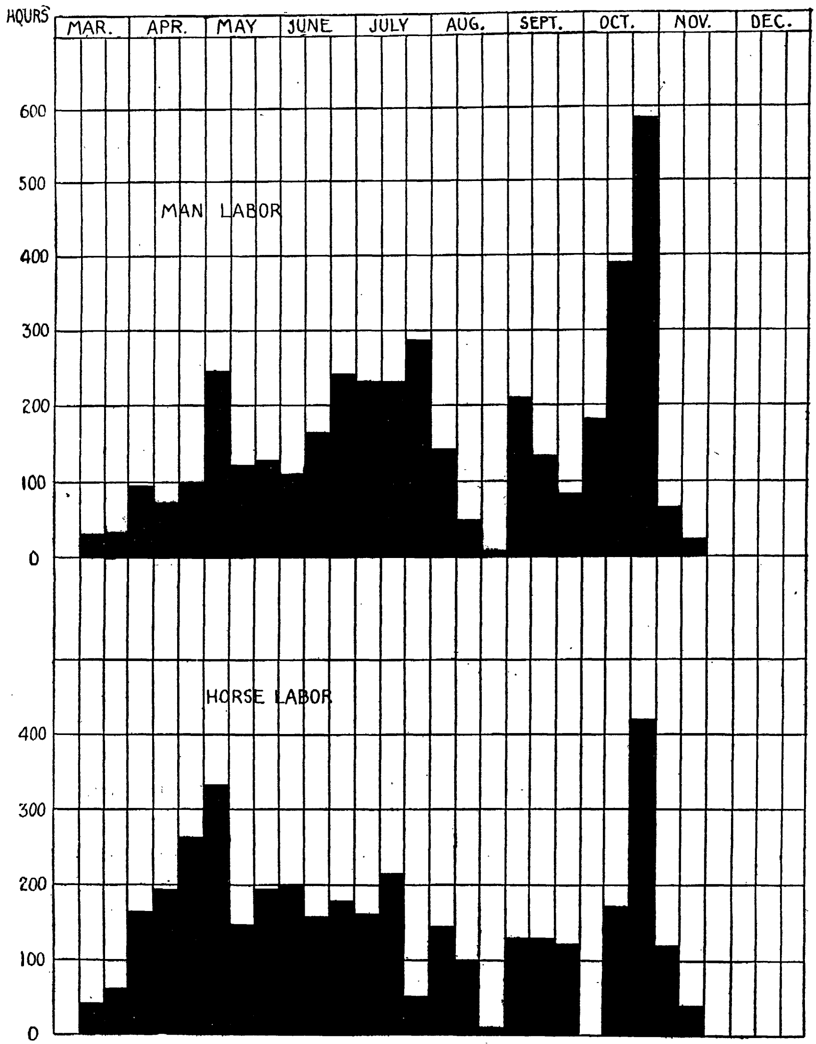

FIG. 4.—Distribution of field labor on field crops on a New York potato and bean farm. Crops grown: Beans, 19.4 acres; hay, 19.6 acres; orchard, 3.5 acres; peas, 4.9 acres; potatoes, 20.5 acres.

October is due to potato digging. Horse labor on this farm is unusually well distributed except during the first third of May, the last of July, the last of August, and the first of October. Potatoes and beans, the leading crops on this farm, compete strongly with each other in the matter of labor requirements. Yet both are crops that yield better than average returns, and it is therefore permissible to grow both of them even if they do compete with each other. If the gaps in the system could be so filled as to make a better distribution of labor the system would be very satisfactory.

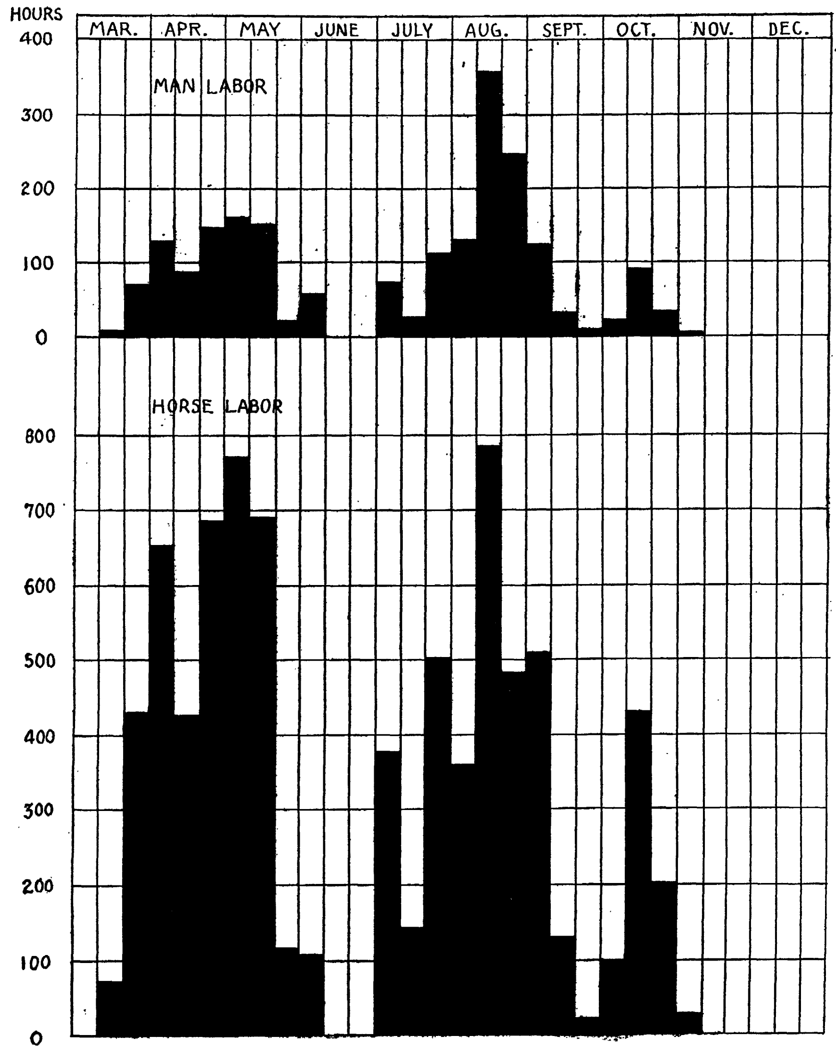

FIG. 5.—Distribution of field labor on a Dakota grain farm. Crops grown: Wheat, 280 acres; oats, 127 acres; barley, 60 acres; flax, 49 acres; hay, 20 acres; fallow, 52 acres.

EXAMPLE OF A DAKOTA GRAIN FARM.

Figure 5 shows the labor requirement of a grain farm in one of the Dakotas. With the exception of 20 acres of hay, which is harvested during grain harvest, and 52 acres of fallow, which give a little work in midsummer when the season permits, this farm is devoted to small grains, which give two principal labor periods during the season, at seeding time and at harvest, with a less important period late in the fall, when fall plowing for next season's crop is done to as great an extent as the season will permit. Corn, potatoes, and millet are crops that might possibly help to fill the two gaps in this system. In localities where corn succeeds, that crop would certainly help to correct the defects in this system, though so far north as the Dakotas it might be necessary to use it for silage or hay.

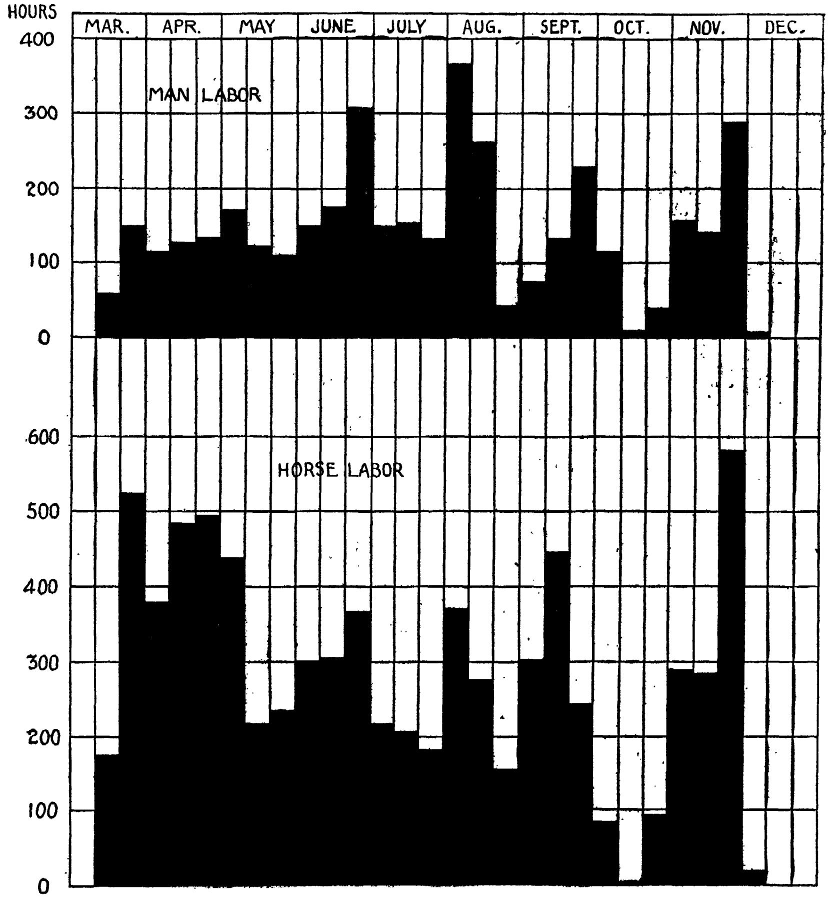

FIG. 6.—Distribution of field labor on a general farm in the Middle West. Crops grown: Corn, 94.82 acres; oats, 27.80 acres; spring wheat, 7.48 acres; winter wheat, 7.63 acres; barley, 5.97 acres; hay, 36.97 acres; alfalfa, 7 acres; timothy (for seed), 48.27 acres; potatoes, 4.08 acres.

Millet could be sown late in June. Buckwheat is another crop that would fit in these gaps.

EXAMPLE OF A GENERAL FARM IN THE MIDDLE WEST.

The labor requirements of the crops on a general farm in the Middle West are shown in figure 6. The man labor is rather well distributed on this farm. The large amount of labor required the last of June is caused by hay harvest, that early in August by the thrashing, that late in September by corn cutting, and that late in November by corn husking. At all these periods extra labor must be employed on practically all farms growing any large acreage of these crops. The main thing is to have a system that distributes the labor of regular employees so as to have them profitably employed at all seasons. The horse labor on this farm is not so well distributed. The amount of work to be done late in March, during April, and early in May would make it necessary to keep four teams on this farm. Yet there are nine 10-day periods during which half or more of these horses are idle. It would be possible to improve the distribution of horse labor on this farm, as will be seen in what follows.

SUMMARY OF THE DATA REQUIRED.

As previously stated, in order to plan a cropping system that will properly utilize the time of the farmer and his help, it is necessary to know the dates at which each of the necessary operations will occur, the amount of labor each will require, and the character of the crews that should work together to accomplish the work economically. This information is available for the leading field crops of the country from records in the files of the Office of Farm Management. The Bureau of Statistics of this department is also collecting data on the average dates of planting and harvesting crops in all sections of the country, and the writer desires to acknowledge the courtesy of the officials of that bureau who have permitted him to use certain of these data in advance of their publication by that bureau.

DETAILS OF A HYPOTHETICAL SYSTEM.

In order to show the possibilities in the way of fitting crops together in a cropping system in such a way as to eliminate as largely as possible competition between crops for labor at the same time, the details of a hypothetical system are here given.

Figure 7 shows the estimated distribution of field labor on an assumed rotation consisting of six 40-acre fields, or 240 acres in all, the succession of crops on any one field being corn, corn, wheat, wheat, and timothy and clover two years. The dates at which the various operations are performed are those for the latitude of northern Virginia to central Missouri. In these estimates it is assumed that between April 1 and November 30 two days out of three will be available for field work, an assumption based on the experience of several successful farmers in the Middle West. In March it is assumed, on a similar basis, that on the average about one day in two is available.

Figure 8 and the accompanying table give the details of the labor on this six-year rotation as accurately as data now available permit.

In figure 8 the date, amount, and kind of work on each crop is shown graphically, the upper half of the figure showing the man labor, the lower half the horse labor. In each case the bottom line shows the total labor in each 10-day or 11-day period. The symbols used to denote the various operations are explained at the left-hand margin of the figure. The height of the polygons in figure 8 shows the number of men or horses working; the horizontal width shows the time

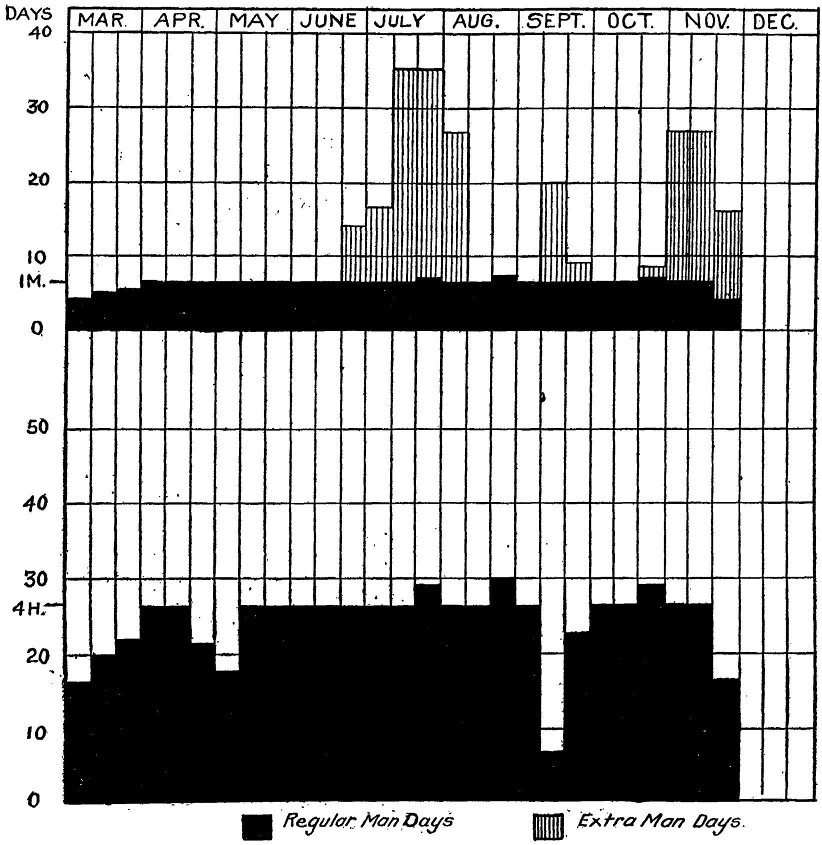

FIG. 7.—Estimated distribution of labor on 80 acres each of corn, of wheat, and of timothy and clover hay in the latitude of central Missouri. One man and four horses regularly employed. Extra man labor at harvest. Rotation: Corn, corn, wheat, wheat, hay, hay.

required. As to the matter of time required by each operation it is assumed, as explained, that between April 1 and November 30 one-third of the time is lost because of rain, Sundays, and the like, so that each day of work is spread out over $1\frac{1}{2}$ days in the figure. Thus, the work of $6\frac{2}{3}$ days in a 10-day period is made to occupy the full 10 days in the diagram. During March a single day's work is made to cover the time of two days.

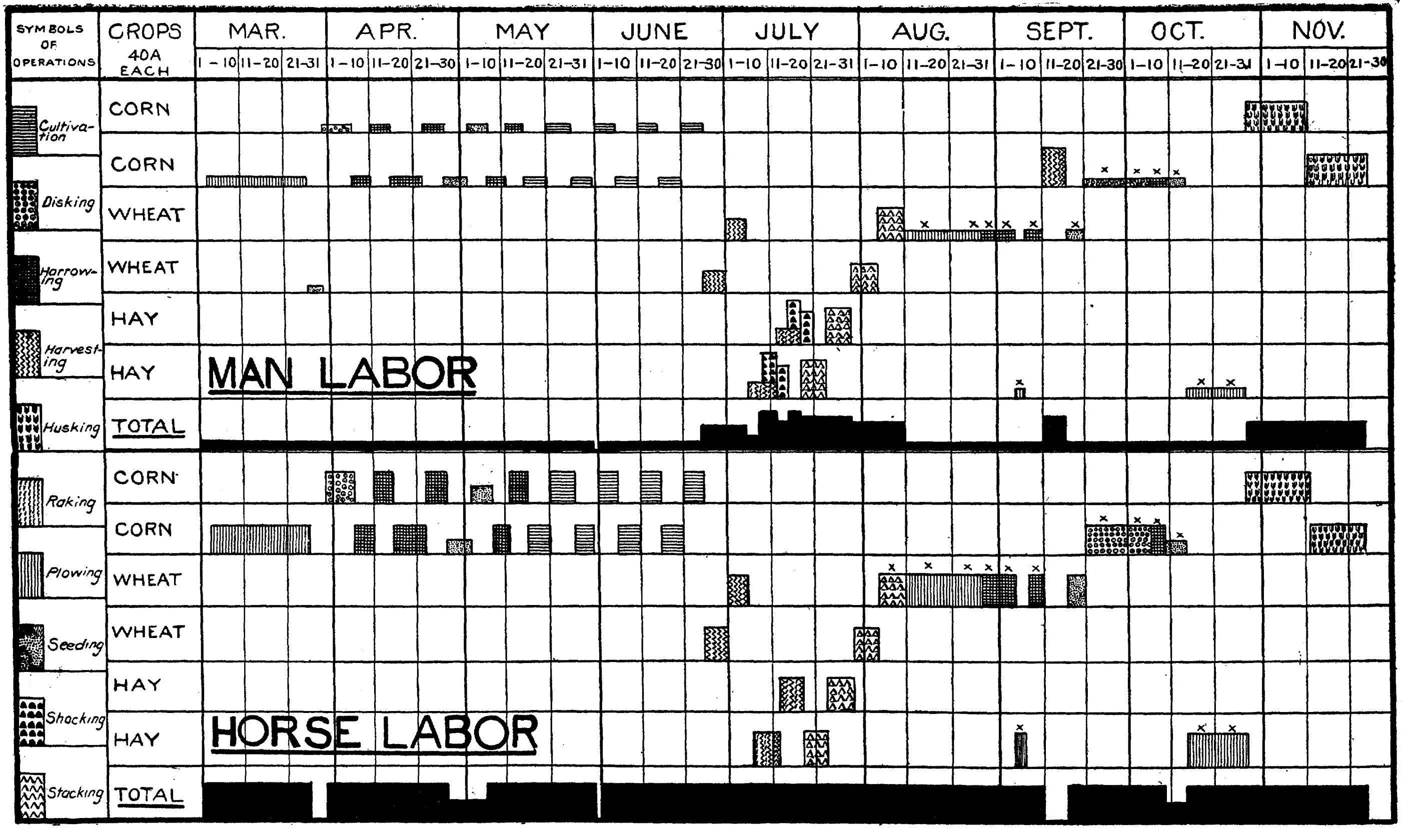

FIG. 8.—Detailed work schedule of field labor on 240 acres of crops. The vertical height represents the number of men or horses, the horizontal distance, time occupied. In March, one day's work covers two days' time. Later, one day's work covers one and one-half days' time. X shows work on following crop.

Estimated seasonal requirement and distribution of labor necessary to produce 80 acres each of corn, of wheat, and of timothy and clover hay, in a 6-year rotation, in the latitude of central Missouri.

Months.	Days.		Work on each of the six fields.[1]						Extra labor.[2]			Regular man (days).	Horse labor.	
	Of month.	Available.[3]	Corn, 40 acres.	Corn, 40 acres.	Wheat, 40 acres.	Wheat 40 acres.	Hay, 40 acres.	Hay, 40 acres.	Men.	Days.	Total days.		Number of horses.	Days.
March	1–10	5		p 1–4 4								4	4	4
	11–20	5		p 1–4 5								5	4	5
	21–31	5½	d 1–4 1	p 1–4 2½		sx 1–0 2						5½	4	3½
April	1–10	6⅔	d 1–4 4	h 1–4 2⅔								6⅔	4	6⅔
	11–20	6⅔	h 1–4 2⅔	h 1–4 2⅔ h 1–4 1⅓								6⅔	4	6⅔
	21–30	6⅔	h 1–4 2⅔	h 1–4 1⅓ s 1–2 2⅔								4 2⅔	4 2	4 2⅔
May	1–10	6⅔	s 1–2 3⅔	s 1–2 1 h 1–4 2								6⅔	2 4	4⅔ 2
	11–20	6⅔	h 1–4 2⅔	h 1–4 0⅔ c 1–4 3⅓								6⅔	4	6⅔
	21–31	7⅓	c 1–4 3⅓	c 1–4 3⅓								6⅔	4	6⅔
June	1–10	6⅔	c 1–4 3⅓	c 1–4 3⅓								6⅔	4	6⅔
	11–20	6⅔	c 1–4 3⅓	c 1–4 3⅓								6⅔	4	6⅔
	21–30	6⅔	c 1–4 3⅓			k 3–4 3⅓			2	3⅓	6⅔	6⅔	4	6⅔
July	1–10	6⅔			k 3–4 3⅓			kr 2–4 2 kro 6–4 1⅓	2 1 5	3⅓ 2 1⅓	6⅔ 2 6⅔	6⅔	4	6⅔
	11–20	6⅔					kr 2–4 2 kro 6–4 2 o 4–0 2	kro 6–4 0⅔ o 4–0 2 a 5–4 2	5 8	4⅔ 2	23⅓ 16	6⅔	4	6⅔
	21–31	7⅓				a 4–4 1⅓	a 5–4 4	a 5–4 2	4 3	6 1⅓	24 4	7⅓	4	7⅓
August	1–10	6⅔			a 4–4 4	a 4–4 2⅔			3	6⅔	20	6⅔	4	6⅔
	11–20	6⅔			px 1–4 6⅔							6⅔	4	6⅔
	21–31	7⅓			px 1–4 4⅔ hx 1–4 2⅔							7⅓	4	7⅓
September	1–10	6⅔			hx 1–4 2⅔ hx 1–4 2⅔			px 1–4 1⅓				6⅔	4	6⅔
	11–20	6⅔		k 5–0 4	sx 1–4 2⅔				4	4	16	6⅔	4	2⅔
	21–30	6⅔		dx 1–4 5 dx 1–4 1⅔								6⅔	4	6⅔
October	1–10	6⅔		dx 1–4 3⅓ hx 1–4 2⅔ sx 1–4 0⅔								6⅔	4	6⅔
	11–20	6⅔		sx 1–4 2				px 1–4 4⅔				6⅔	4	6⅔
	21–31	7⅓	ul 4–4 2					px 1–4 5⅓	3	2	6	7⅓	4	7⅓
November	1–10	6⅔	ul 4–4 6⅔						3	6⅔	20	6⅔	4	6⅔
	11–20	6⅔	ul 4–4 0⅓	ul 4–4 6⅓					3	6⅔	20	6⅔	4	6⅔
				ul 4–4 2⅔					3	2⅔	8	2⅔	4	2⅔
Extra man labor											179⅓			

[1] EXPLANATION.—Letters: a, stacking; c, cultivating; d, disking; h, harrowing; k, cutting; l, hauling; o, shocking, cocking, etc.; p, plowing; r, raking; s, seeding; u, husking; x, work on succeeding crop. Figures under crops: 5–4 2 means 5 men and 4 horses, 2 days; 1–4 2 means 1 man and 4 horses, 2 days; etc.

[2] Extra horse labor, none.

[3] Estimate of available days: 1 out of 2 in March; 2 out of 3 from April to November, inclusive.

Figure 8 and the table show that in a normal season, with no unusual mishaps, one man, using 4-horse machinery, could do all the field work required by these crops by hiring about 180 days' extra man labor at harvest time. The four horses could do all the field work required at all seasons. They would, however, be thoroughly busy throughout the season, two days out of every three (one day in two during March). This is 60 acres to the horse and 240 acres per man (regularly employed on field crops). It would require a high degree of executive ability to carry out this plan and few men could do it. The writer's object is not to show here a workable plan; that will come later when farm-management investigations have progressed much beyond their present status. The aim is rather to call attention to the importance of studying the labor requirements of different crops and different farm operations so that we may have the data necessary to make working plans for farms that will secure a more economic use of the time of the farmer and his laborers and of his work stock. At present it is estimated that the average farm work horse is used only about $3\frac{1}{2}$ hours a day, even on fairly well managed farms. The irregular distribution of man labor on most farms greatly magnifies the difficulty of securing satisfactory labor. If investigations of the character suggested in this article will help to remedy these difficulties they are well worth while.

SOME RESULTS OF THE FARMERS' COOPERATIVE DEMONSTRATION WORK.

By Bradford Knapp,
Special Agent in Charge of the Farmers' Cooperative Demonstration Work, Bureau of Plant Industry.

THE PURPOSE OF THE WORK.

The general purposes of the Farmers' Cooperative Demonstration Work have been repeatedly outlined in literature published by the Department of Agriculture. There still seems to be a lack of information as to the purposes, scope, and success of this work, especially in States where it is not being carried on. It is the intention in this paper to take up briefly the development of the work and to give some of the results accomplished, for the purpose of furnishing additional knowledge of a movement which has assumed large proportions in the Southern States.

CONDITIONS IN THE COTTON STATES.

The Farmers' Cooperative Demonstration Work was first organized under the late Dr. Seaman A. Knapp in Texas in 1904. Its primary object was to give immediate relief to the sections suffering from the ravages of the cotton boll weevil. The situation was a gloomy one. Cotton was the sole cash crop and was generally raised on what is known as the advance system. The cotton planter or small farmer obtained credit with his banker or merchant for the necessary provisions and supplies to make the crop and generally gave some sort of mortgage upon the crop and often upon his team and tools. At the end of the year the merchant or banker took the crop, sold it, paid the indebtedness for advances, and returned the balance, if any, to the farmer. When the weevil appeared and destroyed the crop, merchants and bankers refused to make advances, and the farmer found himself without credit, without food, and without money. The result of this condition was a financial and agricultural panic. Labor left the country, farms were abandoned, stores closed, and disaster was apparent everywhere.

PRODUCTION OF COTTON IN WEEVIL-INFESTED TERRITORY.

It was the province of the Demonstration Work under the Bureau of Plant Industry to meet this condition and relieve it. The Bureau of Entomology had already investigated the life history of the boll weevil. Armed with this information the work of showing the farmers how to produce cotton in spite of the boll weevil was undertaken. It was recognized immediately, however, that the problem was twofold. As long as the merchant and banker refused credit it was necessary to show the farmer how to produce the food necessary for his own family and how he could live at home on the products of his own farm and still produce cotton. To this end agents were employed who went into the field and instructed the farmer on his farm by getting him to raise a few acres of cotton under instructions prepared by the special agent in charge. At the same time he was instructed in the raising of corn and was urged to plant a home garden. The result was immediate and reassuring. The demonstrators raised cotton in spite of the weevil; at the same time they raised much more corn under the instructions of the agents than they had ever been able to raise before. Diversification became one of the principal means advocated for meeting the ravages of the weevil and has constantly been urged by the agents engaged in this work from the very beginning. The certainty that the weevil would infest all cotton-growing sections of the South made it apparent that the more rapidly the cotton farmer could be brought to diversify the better it would be for the stability of cotton production and the better would he be prepared to meet the weevil.

RESULTS OF SEVEN YEARS' WORK.

Seven years have brought a wonderful growth and many striking results. From a few agents in 1904, upward of 600 agents are now employed. From the instruction of a few farmers in eastern Texas the movement has extended to the instruction of practically a hundred thousand farmers, and from one State to thirteen States. It has established itself as a system for carrying helpful knowledge to the farmer on his own farm by placing a demonstration on his land and securing such active cooperation on his part as to bring about the adoption of the method demonstrated.

The salient features of this work have been outlined heretofore and it is hardly necessary to repeat them. The most important points in the system are the following:

(1) The personal contact of a competent local agent with the farmer receiving instruction; (2) the participation of the farmer in the demonstration; and (3) the certainty of success, under normal conditions, of the farm methods advocated.

By a competent local agent is meant one who not only has a knowledge of agriculture but who has had experience and is able to view problems from their practical as well as their scientific standpoint. He must be a man of character and able to secure and hold the confidence and respect of the farmers among whom he works.

THE PRACTICAL NATURE OF THE WORK.

The vast majority of the activities of the Department of Agriculture are aimed at the acquisition of knowledge by research and investigation. In the largest sense of the word the Farmers' Cooperative Demonstration Work is not a work of investigation. True, it profited and is profiting by experience, but its aim was and is to take knowledge already acquired and use it in the solution of a problem by giving it the widest possible dissemination through demonstration. It seeks to convert acquired knowledge on the part of experts into common practice on the part of farmers.

Not being investigational in character, it is at once apparent that the results of this work can not be easily tabulated, nor do they adapt themselves readily to presentation in the form of mere statistics of results obtained. The simple statement that a thousand farmers in a particular State under the direction of the department produced an average yield per acre of the standard crops of twice or three times the ordinary yield conveys information of but a small part of the actual effect of the fact stated. The arousing of an interest in agriculture, the creating and increasing of a desire for information, and the rapid acquisition of knowledge through participation in demonstrations are matters which can not be subjected to tabulation. Nevertheless, the results of this work have been so far-reaching in character that they deserve mention. Without attempting to reduce them to the form of scientific information, an attempt will be made to detail some of the results accomplished in the seven years that this work has been carried on.

PRODUCTION OF COTTON.

The Farmers' Cooperative Demonstration Work is accomplishing its original purpose of demonstrating that cotton can be raised in spite of the cotton boll weevil and is meeting the weevil problem as it advances. From the very inception of the work demonstrators who have followed instructions carefully have almost invariably produced a paying crop of cotton.

Seasons have varied and climatic conditions differ in different sections of the cotton belt. The system of attack has been varied to suit the differing conditions. Experience shows that the first inclination of the farmers generally, in sections where the weevil is at its worst, is to abandon cotton production almost entirely for a short time. Gradually the pendulum swings back, and meantime they have demonstrated their ability to produce other paying crops. In eastern Texas, for example, they have come back almost to the normal production of cotton and, in addition, are producing a variety of other crops and have a number of other agricultural interests, resulting in a much more prosperous condition in that section.

In Louisiana the return to normal cotton production has been much slower because of the increased rainfall and the unfortunate seasons that have served to accentuate the condition. It may be said that, generally speaking, the actual damage done by the weevil is always vastly overestimated, because all reduction in the total yield of the crop and its yield per acre are invariably attributed to the weevil. Unfavorable seasons, other pests, and peculiar weather conditions that serve to make the crop production fluctuating are entirely forgotten. During the season of 1910, however, a large number of successful demonstrations were conducted on large tracts of land in alluvial sections of Louisiana, resulting in the production of excellent crops of cotton in spite of the weevil. These demonstrations, varying in size from an acre to 2,000 acres and in yield per acre from half a bale to a bale, made a splendid impression upon the public mind. The farmers of that State have in the meantime learned the lessons of diversification and are now greatly interested in the production of corn, peanuts, peas, and of grasses and clover both for hay and pasture, and they have become interested in hog raising and the general live-stock industry as part of a permanent system of agriculture.

A small town in Avoyelles Parish, one of the most devastated sections of Louisiana, is surrounded by a territory which until 1904 produced practically nothing but cotton, about 4,000 bales being shipped annually from that station. At that time it had one bank with deposits of $52,000. The financial panic of 1907 and the advent of the weevil in 1908 created great demoralization. Some preliminary work was done in 1908, but an agent was not placed there regularly until the spring of 1909. The plan of producing all home supplies, of diversifying, and of demonstrating the growing of cotton under weevil conditions was pushed with vigor. In 1910 this town handled only 1,000 bales of cotton, a reduction of 75 per cent, but with the system of diversification well established the bank mentioned had on deposit $102,000, and five other banks have been organized in the parish.

In 1910 a small town in Acadia Parish shipped poultry to the value of $55,000, 65,000 bags of rice, 3 carloads of hogs, and 2,400 bales of cotton.

The State of Mississippi is now passing through its crucial period. The devastation in Adams, Wilkinson, Jefferson, Claiborne, Amite, and Franklin Counties was as much due to panic and the withdrawal of credit as to the actual ravages of the weevil. Restoration will probably be slow in that section until the lessons of diversification, which they are taking up rapidly, are learned. Sections north and east of the one specified have suffered less because of the more united and consistent effort on the part of business men and farmers generally to avoid panic. As the weevil progresses in Mississippi the farmers who are following instructions are raising cotton in spite of the weevil. The difficulty has been that the State has been visited by two very disastrous seasons, and the seasonal misfortune had to be combated as well as the weevil. Where consistent effort is made by the farmer to prepare for the weevil and to do the things advocated by the department no serious complaints are heard.

In territory beyond the advance of the weevil a great effort is being made to demonstrate better methods of crop production, the advantage of seed selection, the production of home supplies, and the changing as fast as possible of the economic system, so as to be ready to meet the weevil when it comes. In this branch of the work the department is meeting with remarkable success. Special mention should be made of the success attained in obtaining diversification in southern and southwestern Alabama.

So much in a brief way for the work that the Farmers' Cooperative Demonstration Work has been doing for cotton production under boll-weevil conditions. Each year its demonstrators in weevil territory have produced good crops of cotton, and during that time they have had to face almost every kind of a season that it is possible to imagine. Success during these adverse seasons has emphasized the importance of the result and greatly helped to reestablish confidence. But this preliminary work is but a small part of the general effect of the work on southern agriculture and details but a small portion of the results accomplished in the field.

CORN AND COTTON.

As tending to show the success of the methods advocated by the Department of Agriculture for the raising of standard crops of corn and cotton in the South, the table on page 290 is presented, showing the production of these crops in the Southern States during the seasons of 1909 and 1910.

The figures contained in this table show the average of demonstration farms from which accurate returns were received. All demontrators are asked to make reports and they are collected by agents, but it is impossible to obtain accurate data from all farmers instructed. Many have no means of weighing or measuring, while others gather their crops without keeping any record unless the agent is present. Data were collected from about 12,000 demonstrators, representing an acreage in cotton of about 85,000 acres and in corn of about 75,000 acres. The averages of each State, as furnished by the Bureau of Statistics, are shown for the sake of comparison. To show the number of pounds of seed cotton per acre the average production in lint as reported has been multiplied by three. As much of the cotton grown on demonstration farms averages above 33⅓ per cent of lint, these figures favor the average farmer rather than the demonstrator. In this connection it should be stated that the total number of farmers instructed during the season of 1911 was 89,764, of whom 26,227 were classed as demonstrators, whose crops were visited at least once every 30 days by an agent of the department, and 63,537 as cooperators, whose farms were visited only occasionally or not at all, but only consulted the agent personally and received printed instructions.

Increased average yield of cotton and corn on demonstration farms over the average yield in several Southern States in 1909 and 1910.

States.	Average yield of seed cotton per acre.				Average yield of corn per acre.			
	Demonstrators.		Entire State.		Demonstrators.		Entire State.	
	1909	1910	1909	1910	1909	1910	1909	1910
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Eastern Texas	690.6	826.1			28.4	34.1		
Western Texas	547.5	578.4			21.8	31.5		
Texas (entire State)	633.3	710.4	375	435	25.4	32.8	14.7	20.6
Oklahoma	527.7	708.1	441	600	26.0	24.1	15.9	16.0
Louisiana	757.8	785.5	390	360	30.8	35.2	16.3	23.6
Arkansas	844.6	915.3	459	525	30.6	36.8	16.5	24.0
Mississippi	1,115.7	933.5	471	546	36.9	41.6	13.1	20.5
Alabama	1,138.4	1,220.2	426	480	33.2	41.4	11.9	18.0
Florida	597.5	572.0	330	330	21.0	23.0	11.3	13.0
Georgia	1,303.9	1,298.0	552	519	34.4	35.4	11.6	14.5
South Carolina	1,204.9	1,294.3	630	648	36.1	41.0	13.3	18.5
North Carolina	1,238.2	1,332.7	630	681	40.0	43.4	13.9	18 6
Virginia					41.0	46.5	20.6	25 5

INCREASE IN CORN CROP IN THE SOUTH.

The campaign carried on through the boys' corn clubs and the adult demonstrators in raising corn has had a marked influence on corn production in the Southern States. It is probable that the crop for 1911 will not be quite so large as that for 1910, owing to the unfortunate weather conditions at critical periods during the growing season. In 1910 the Southern States made a magnificent corn crop, the largest in their history. Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana, Arkansas, and Texas produced 526,772,000 bushels of corn, or 195,874,000 bushels more than in 1909. Arkansas showed an increase of 19,750,000 bushels. Mississippi increased its crop from 28,429,000 to 53,095,000 bushels, Alabama from 30,696,000 to 56,300,000 bushels, and South Carolina from 20,872,000 to 31,580,000 bushels. The estimates of this department for 1911 for these States are as follows: Mississippi, 54,150,000; Alabama, 54,000,000; and South Carolina, 32,578,000 bushels. The figures for Georgia show an increase from 39,375,000 bushels in 1909 to 51,982,000 in 1910, and the yield is estimated at 59,072,000 bushels in 1911. In each of these States a large force of local agents in the Demonstration Work has been employed.

At the same time statistics show that there has been a gradual and general increase in the average production of corn per acre in each of these Southern States during the past three years.

DIVERSIFIED FARMING.

The Farmers' Cooperative Demonstration Work has been instrumental through its field agents in establishing diversified farming in many sections of the South. The one-crop system, whether the crop be cotton, wheat, or tobacco, has generally proved a failure as a permanent system of general farming and a constant menace to prosperity, especially where the economic system tends to throw the crop on the market at a certain period of the year. Under the credit system every influence is brought to bear to increase the acreage of the one cash crop to the detriment of the system of farming and the destruction of soil fertility. By diversification it is possible for the southern farmer to produce most of his home supplies in the way of vegetables, meat, and other foods, to produce enough corn, hay, and forage for a profitable live-stock industry, to use legumes for building up the fertility of his soil, and to raise his cotton as a cash crop on a smaller acreage but with a larger production per acre and without having his financial condition dependent upon its fluctuating price. There is no question that the Farmers' Cooperative Demonstration Work has greatly helped in the movement in this direction in the South. Credit is to be given to the colleges and to other forces working in hearty cooperation toward the same end.

The work its force of agents has accomplished in arousing a general interest in the live-stock industry is one of the most important results of the demonstration work. Thousands of demonstrations in the raising of corn and forage crops especially adapted for the feeding of hogs and cattle and the introduction of permanent tame pastures for grazing have opened the eyes of the farmers generally to the possibilities of the South as a live-stock country. The Bureau of Animal Industry, through its division of tick eradication and the dairy division, has been doing splendid work, but the industry has been assisted by the overwhelming evidence that the South can produce the necessary feed for live stock. Each agent reports a number of demonstrators and farmers generally in his county who have gone into dairying or hog raising as a result of his efforts. Recently the definite question was sent to 109 agents, scattered through 10 States, and the replies show that 1,309 demonstrators in the 109 counties represented had engaged in the raising of hogs for the first time during the years of 1910 and 1911, and that 40 of these demonstrators had gone into hog raising as a business and had purchased the best blooded stock. Many are becoming interested in silos and in dairying and some in the feeding of cattle, as a result of the fact that they are beginning to produce a surplus of corn and forage crops.

The better methods advocated and the constant preaching of the doctrine of more horse power and less hand power have resulted in the use of better farm machinery in the South. Formerly much of the cotton was put in by the use of a mule and a 1-mule turning plow, and a great deal of it was cultivated with the same tool. It is not unusual to find counties in the South with an agent of the department at work for a few years where there have been more farm tools of an improved sort sold in the last 2 years than were sold in 20 years before. Especially is this true of 2-mule plows, disk and gang riding plows, disk or cutaway harrows, smoothing harrows, and improved implements for cultivation.

COOPERATION WITH FARMERS.

The Farmers' Cooperative Demonstration Work has clearly established the principle of demonstration through cooperation with the farmer as a means of disseminating agricultural knowledge. A great many very able men have advocated the establishment of what they have termed "demonstration farms," which are entirely different from the method used by the department in this work. These single model farms or experiment stations doubtless attract a great deal of attention and serve to disseminate considerable useful and valuable information to the farmer, but it has been clearly shown by this work that the carrying on of 25 to 150 demonstration farms in a county in cooperation with farmers will much more rapidly place the necessary information in the possession of the man who needs it than will the maintenance of one model farm. The doing of the work by the farmer instructed is a means of driving home the lesson in a much more emphatic and lasting manner than the occasional observation of a farm located at a distance from his home.

In this connection, special attention is called to the fact that in every State and county where this work is being carried on it has for its demonstrators many educated and intelligent farmers of the South, men of high standing, often of college education, and recognized as capable and resourceful business men. It gains their support and they willingly become demonstrators. At the same time it also succeeds with the ordinary man or the man of little ability. With the poorer classes and tenants of the South it is a question of being shown how. The more intelligent and highly educated farmer is perfectly willing to be shown how and at the same time is glad to come in touch with the Department of Agriculture and inquire into the why and wherefore. To such a man the local agent becomes a continuing source of information. The amount of general information of a useful character which is disseminated by these agents in the field can scarcely be estimated by anyone who is not familiar with the activities of the demonstration work.

COOPERATION OF ASSOCIATIONS, COUNTIES, AND STATES.

Rapid strides have been made in securing cooperation in carrying on this work. The readiness with which the people have supported it by financial contribution is the best evidence of its popularity and of what it is accomplishing. The late Dr. Seaman A. Knapp once said that this work first influenced the individual, next the community, and finally the public opinion of the State. This third period of development has already been reached. For two or three years past, individuals, associations of business men, farmers' organizations, and county governments have been voluntarily contributing to assist the department in extending the work. These contributions have been made for the sole purpose of assisting the department to do work in sections where it could not otherwise go on account of lack of funds.

With this large force of men in the field, with the people of the counties seeing the actual results in crop production and in improved conditions in the country, public opinion has been rapidly crystallized and this work has now come to the point where it is influencing the public opinion of the State. In proof of this, it need only be said that Virginia, North Carolina, Alabama, Arkansas, Mississippi, and Texas have passed laws within the past two years permitting county boards of supervisors or officers occupying similar positions to appropriate money for the purpose of cooperating with the demonstration work. In the case of Mississippi, while the law does not specifically mention cooperation a number of counties have taken advantage of the law to cooperate with the department. Virginia, South Carolina, Florida, and Alabama have passed laws appropriating money to be used in active cooperation with the department in carrying on this work. The amounts appropriated by these States vary from $5,000 to $25,000 per annum. In the case of Alabama, the State appropriating the highest amount, the cooperation makes it possible to place a local agent in every county. In North Carolina, Arkansas, and Texas the counties are paying at least half of the salary of the local agent. In South Carolina and Florida the State appropriation enables the department to appoint additional county agents.

In addition, it should be stated that the agricultural colleges of Arkansas, Louisiana, Mississippi, Alabama, Georgia, North Carolina, and South Carolina are directly cooperating in the work of carrying on the boys' corn-club work. In these instances an agent is appointed by the department in cooperation with the college and such agent takes charge of organizing and conducting clubs in the State.

The agents of the department are everywhere endeavoring to cooperate with the colleges and experiment stations and all other agricultural forces working in the same field. They are endeavoring to use the material gathered by the investigations and researches of the Department of Agriculture at Washington and by the several State experiment stations for the benefit of the farmer who is being instructed.

In addition to the contributions already mentioned, the General Education Board of New York has annually, since 1906, appropriated sums of money to be used in extending the work to cotton-producing States at a distance from the weevil. The force employed is controlled by the department absolutely, and the only difference is that the salary of these agents is paid direct from the fund thus appropriated.

To sum up the entire cooperation the department is receiving, it may be stated that for every dollar appropriated by Congress for the support of this work in the Southern States an equivalent sum is devoted to it from some other source, so that the people themselves and those interested in their welfare are practically duplicating the appropriation made by the United States Government. All of this cooperation is carried on in the most cordial and helpful manner and with practically no friction.

BOYS' CORN CLUBS.

The Farmers' Cooperative Demonstration Work has greatly assisted in the solution of many educational and agricultural problems by establishing a very complete system of boys' corn clubs throughout the Southern States. This subject is too large to permit of any lengthy discussion at this time. Corn clubs had been organized before the department undertook to organize them in connection with this movement in the South, but during the period of extension of the Demonstration Work clubs were established as a means of assisting the department in arousing an interest in agriculture. They were organized systematically in cooperation with the school system and with the assistance of the local agents, together with the unbounded enthusiasm created in the general public. One of the important features is that yield, economy of production, quality of product, and a written account of work are all made to have their proper weight in determining the prize winner. In four years this branch of the work has grown from a few clubs with but few boys enrolled to an enrollment of nearly 60,000, extending over 13 States. The clubs have served the excellent purpose of assisting the department in breaking down local prejudice in certain communities against those who have often been termed "book farmers"; they have aroused the interest of the adult as well as of the boy; they have helped to crystallize public opinion in favor of practical education; they have assisted school-teachers in vitalizing their work; they have attracted the boys to the things of the farm, and have served to give them an object lesson in the possibilities of farming as a vocation.

DEMONSTRATION WORK AS A BUSINESS HELP.

As the Farmers' Cooperative Demonstration Work naturally deals with the practical problem of producing crops upon the farm, it takes to the farmer much information that is helpful in a business way, besides information as to how he may obtain the greatest yield. It has always endeavored to guide the farmer in making the maximum yield at the minimum cost. It often helps the poor farmer by practical suggestions on the business side. Helpfulness of this sort greatly stimulates the desires of those who have not gotten ahead very rapidly in a financial way heretofore. The ordinary good tenant needs but the slight stimulus of a little helpful information to be placed upon the highroad to ownership of land. An increased production per acre, the practicing of economy in carrying on farm operations, and especially a few helpful hints as to how money may be saved by producing upon the farm supplies usually purchased at the grocery store, create a desire for ownership of land. In the past few years of the department's experience in carrying on this work, its agents in the field have repeatedly observed the fact that the better tenants who became demonstrators were soon confiding to the agent that they were saving money for the purpose of buying a farm. It is impracticable to give figures showing the number of tenants who, under the influence of this work, have bought farms either in the same locality or in some other locality. The reports from all the 600 agents in the field show a tendency in this direction. Many farmers who were in debt and in hard straits have become demonstrators and have subsequently reported that their indebtedness has been entirely wiped out, that they have greatly increased the value of their live stock, and have money in the bank. The reports also show that a large number of tenants, after several years of demonstration in cooperation with the department, have purchased farms.

DR. KNAPP'S CONCLUSIONS.

In the Yearbook of the department for 1909 the late Dr. Knapp said:

> The Farmers' Cooperative Demonstration Work may be regarded as a method of increasing farm crops and as logically the first step toward a true uplift, or it may be considered a system of rural education for boys and adults by which a readjustment of country life can be effected and placed upon a higher plane of profit, comfort, culture, influence, and power.

The results obtained by the work substantiate that statement. The great problem of the present is the dissemination of knowledge actually in existence, and here is a system for doing so that has been tried and not found wanting. Many thinking men are led to believe that the best method is investigation and still more investigation, but the time has come when the result of years of investigation should be universally known. Dr. Knapp stated further:

> There is much knowledge applicable and helpful to husbandry that is annually worked out and made available by the scientists in the United States Department of Agriculture and in the State experiment stations and by individual farmers upon their farms, which is sufficient to readjust agriculture and place it upon a basis of greater profit, to reconstruct the rural home, and to give to country life an attraction, a dignity, and a potential influence it has never received. This body of knowledge can not be conveyed and delivered by a written message to the people in such a way that they will accept and adopt it. This can only be done by personal appeal and ocular demonstrations. This is the mission of the Farmers' Cooperative Demonstration Work, and it has justified its claims by the results. * * *
>
> The demonstration method of reaching and influencing the men on the farms is destined ultimately to be adopted by most civilized nations as a part of a great system of rural education.

DECOMPOSITION AND ITS MICROSCOPICAL DETECTION IN SOME FOOD PRODUCTS.

By Burton J. Howard,

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GENERAL DISCUSSION.

The recognition and evidence of decay in crude food products is a matter of common knowledge and practice, for every housewife in preparing fruits or vegetables, whether for preserving or for table use, is careful to remove all those parts which bear evidence of decay. She recognizes the fact that certain marked changes have taken place in the product which make portions of it undesirable as a food. Fruits or vegetables in a partially decayed state are rejected, not altogether because of danger to health, but as much, perhaps, because the flavor of the decayed portion has been impaired. A little reflection is sufficient to show that the question of decomposition in food products is a very broad one and presents many questions for study. The microscopy of decay also varies in different kinds of products. Therefore in the present case it is intended to consider only certain phases of the question as presented in fruits and fruit products.

The Federal pure food law voices the demand of the consumer for sound foods when it declares as adulterated a product which is in whole or in part composed of a filthy, decomposed, or putrid animal or vegetable substance. The gross raw materials manifestly come under this provision as well as the manufactured product, though, from the standpoint of protecting the consumer from objectionable materials, its application to the manufactured product is probably of more importance, because the consumer usually rejects for himself decayed tomatoes, apples, plums, and similar products in the whole condition. In manufactured form, however, the consumer is often unable to detect conditions which, if he knew them to be present, would cause him to refuse the product. Small consideration can be given to any producer of food products who uses decomposed or decayed ingredients with the excuse that their presence is not observed in the finished product. No manufacturer has any ethical right to sell to a consumer a product made from such material that the consumer would refuse to buy if he knew of its presence.

This demand for a greater degree of care in the production of clean, wholesome products is being met by progressive manufacturers in a gratifying manner. Many are discarding or radically modifying old systems of handling, and others realizing that the use of certain kinds of decayed stock is indefensible, are discontinuing the practice. Many firms which formerly paid little attention to sorting tomatoes before making pulp for ketchup or soup stock have come to realize that without this precaution—one which every housekeeper would take—it is impossible to guarantee a satisfactory product. Workers in some canning establishments have implied that they would not use the output of the factories where they were employed because of their knowledge of the character of the raw material from which it was made. Such statements are sad commentaries on the methods of any firm, for it should be that the intimate knowledge of its practices on the part of the employees would be one of the best advertising assets the firm could have.

As popularly recognized, decay is associated with certain physical changes in the product affecting the color, odor, taste, and texture. At times only one of these changes may be detected by an ordinary inspection, but it is more common to find two or more of them combining to produce the final result. Thus in the case of some decaying fruit all of these changes may be present. A study of the question proves, however, that the effects of decay are more deeply seated than is shown simply by these gross changes. There are changes produced in the chemical constitution of the product whereby an essentially new kind of substance is produced. A careful consideration of the question will serve to show that the term "decomposition" is of wider application than is indicated by such gross samples as those just given, since in its strict sense it means a breaking down of the normal product. It sometimes happens that changes take place which are only slightly evident to the natural senses, although the character of the product has been so changed as to render it positively injurious. Notable examples of this condition are found in those forms of decomposition which result in the production of ptomaines, which are poisonous products present under certain conditions, and which cause such slight changes that they can not be detected by the senses. Fortunately, nearly all forms of decomposition are such as to be within the control of the manufacturer in that they usually result from delay in making up the product or else to carelessness in manufacture. Fresh, sound materials made up promptly under sanitary conditions reduce to a negligible quantity any likelihood of such decay.

CAUSES OF DECAY.

Studies made of decay and decomposition reveal the fact that they are usually produced by the invasion and development of low forms of plant growth. There are a few cases of so-called physiological decays for which no organism has been detected as the direct cause. In these cases the tissues show a change in color and in texture, as well as a deterioration in flavor. Examples of this type are comparatively rare, and are practically negligible as compared with the more usual cases of decay. Usually the spoilage is due to one or more kinds of organisms which gain access to the fruit, penetrate the tissues, and feed upon certain of the natural constituents, reproducing themselves in enormous numbers, modifying or destroying the natural properties of the fruit, and introducing new ones. In this way they produce, among other results, those gross changes which are so familiar in decay.

The organisms responsible for producing decay belong principally to one of three classes: (1) molds, (2) yeasts, and (3) bacteria. It sometimes occurs that a single species of one of these may be responsible for a given case of simple decay, while on the other hand it more frequently happens that two or three of these types may be present, in which case a complex condition results. Regarded from the time when the invasion occurs, the different kinds of decomposition might be roughly divided into two classes—one of which might be termed "primary" or that which occurs in the raw materials preceding any step in the process of manufacture, examples of which are found in the decaying of raw materials during growth, harvesting, transportation, or storage. By "secondary" spoilage is meant that which occurs at some stage in the production of the manufactured article, examples of which are sometimes found in the fermentation of the partially finished stock stored imperfectly in barrels or other containers. In some products the line of demarcation between these two classes of spoilage is well defined, but at other times one shades off into the other so imperceptibly as to make the drawing of any definite line between them impossible. As a general proposition, however, there are certain characteristics which distinguish the two classes of spoilage, so that by an examination of the final product it may be determined which class is represented.

METHODS OF EXAMINATION.

The detection of certain kinds of decay is possible by chemical methods, but in others this is at present impossible, and hence a microscope is often of the utmost importance. If the product has not been finely divided a hand lens or even the unaided eye may serve satisfactorily for a gross examination, but such cases are comparatively rare, since the manufacturer usually seeks to remove those objectionable portions which could be thus observed. Microscopes giving magnifications of from 90 to 500 diameters are of service. The details of the methods in use in the Bureau of Chemistry are given in Circular No. 68,[1] and are therefore not repeated in detail, though it may not be out of place to state, in general terms, the method used.

For the examination of a sample for molds a small portion of the material is placed on a slide and the cover glass pressed down to make a mount of satisfactory thinness (about 0.1 mm). The normal tomato products show the more or less perfect cell walls with a small amount of coagulated granular cell contents (Pl. XV, fig. 1). The appearance of the contents varies considerably in different parts of the fruit, an accurate idea of which may only be obtained by a detailed study of them. When such cells have been invaded by bacteria, frequently considerable débris is produced which gives a finely granular appearance (Pl. XVI, fig. 2). The mold filaments, when viewed under a power of from 75 to 200 diameters, are visible as fine threads scattered through the substance, or at times forming a tangled mass as shown in Plate XV, fig. 2. After a little experience it is quite an easy matter to detect their presence. It is possible to detect yeasts and bacteria also in this kind of a mount, but the use of a higher power is more satisfactory. Diluting the substance somewhat by the addition of a portion of water also tends to facilitate their detection, since there is then less débris from the cells present to interfere with a view of them.

MOLDS.

PENETRATION OF MOLD AND SPREAD OF ITS EFFECTS.

Molds are low forms of vegetable growth, composed largely of thread-like filaments. These filaments serve the purpose of roots and stems; that is, through them the organism obtains its nourishment, and on them it produces the spores which serve the purpose of seeds in propagating new individuals. Molds are mostly surface-growing forms, in that they develop only imperfectly in the interior of a fruit or package from which air is excluded. An illustration of this is found in the case of mold growing on the top of a dish of fruit, for it is rarely true that it extends more than half an inch into the interior, and usually even much less than that. In such a case by carefully lifting out the moldy portion the filaments will be practically all removed, though the flavor and odor may have penetrated the mass so thoroughly as to affect it all. The spores are usually produced on the exposed surface of the medium upon which it is growing. The examination of a decaying apple or tomato in which mold is the causative organism reveals the little fibers pene-

[1] Tomato Ketchup under the Microscope: With practical suggestions to insure a cleanly product. Circular No. 68, Bureau of Chemistry, U. S. Dept. of Agriculture, 1911.

trating into the fruit (Pl. XVIII, fig. 2). In raw fruit it is often possible, by simple inspection, to determine about how far these filaments have penetrated by the changes produced in the appearance of the fruit at that point.

While in some cases the physiological changes in the appearance of the tissues run closely parallel with the extent to which the mold filaments have penetrated, in other instances the discoloration and change may precede by quite a space the actual point to which the mold has gone. Tomatoes have been repeatedly examined, showing decayed spots in which the filaments of mold were within a millimeter (one twenty-fifth of an inch) of the edge of the appearance which was the visible limit of the decay. In apples, pears, and other similar fruits there is often a browning or some other color change in the appearance of the tissues without the mold filaments being so intimately associated with it. In these cases the effect apparently extends some distance from the cause. This is a fortunate circumstance in connection with the problem of putting up a wholesome product in that it enables the easy rejection of the objectionable part in the process of preparation for use. Thus it usually happens that the housewife, in trimming fresh fruit for use, is able to remove very completely the zone which is infected.

APPEARANCE OF THE FILAMENTS.

The filaments produced by different varieties of molds vary somewhat microscopically, but in general are thin-walled and have more or less granular cell contents. The character of the media upon which the mold is growing influences to a considerable degree the appearance of the growths and also modifies somewhat their microscopical characteristics. Thus it is that sometimes a form which thrives very luxuriantly on one kind of fruit will make a very weak growth on another. If conditions are favorable, spores will be produced on the more or less exposed surface of the fruit. These are often present in enormous numbers and usually give the mold surface a dusty, powdery appearance. The spores sometimes have distinctive colors by which different kinds of molds are popularly designated, as "black" molds, "green" molds, "yellow" molds, etc., though these characters should not be relied on very extensively as a means of identification of the species, for it sometimes happens that different species have spores of very nearly the same color. The spores vary quite widely as to size and shape, some of them being spherical, some cylindrical, and others elliptical. One of the common causes of the so-called "dry rot" on tomatoes is a mold having club-shaped spores (Pl. XVII, fig. 1), while another, producing much the same appearance on the fruit, has crescent-shaped spores.

MOLDS IN THE FINISHED PRODUCT.

The last two forms of mold mentioned usually begin their attack on the fruit in the field while in a green state and culminate soon after the fruit has turned red. In fact, they seem to have the influence of producing a premature and unnatural ripening. A tomato product possessing many of these spores can be definitely stated to have been made from tomatoes which were rotten in the field even before they were picked from the vines. They also produce a browning of the cell contents and a shrinking which is quite characteristic of this form of decay. Even in the completely manufactured product the detection of such cells is often comparatively easy.

One of the molds having cylindrical spores with somewhat rounded ends is a species of *Spicaria* (Pl. XVI, fig. 1), which grows luxuriantly on tomatoes and produces a white velvety appearance; the spores of this species are white in color, as are also the filaments. The growth is especially vigorous where ventilation of the package is poor, or during damp, warm periods. For these reasons great care should be taken to guard against such conditions as far as possible in handling the raw or partially manufactured product.

In some products molds can be detected microscopically as free fragments, but more commonly they are found clinging to fragments of the fruit tissues. When found in such products as ketchup and fruit butters, where the materials have been subjected to a pulping process of some kind, the filaments sometimes appear as single, broken fragments, while at other times the filaments may hold together so tenaciously as partially to resist the pulping process and appear in the product in clumps and masses. It not infrequently happens in some such goods that the clumps are of such size as to be discernible even to the naked eye.

YEASTS.

Yeasts are much simpler organisms than the molds, and commonly consist of cells, which are elliptical or spherical according to the particular variety, and form short branching clusters. When growing undisturbed, a single cluster may attain such size as to be readily seen with the naked eye, but when handled it easily breaks up into the individual cells or short chains of 2 to 5 cells each. When growing on the surface of a fruit some varieties produce a white film, while others present a cloudy appearance and still others may be colored, as, for instance, in the case of some of the red and yellow varieties. In growing they feed principally upon the sugars in the fruit and give off as by-products carbonic acid and alcohol; marked changes in the odor and taste of the product result. When a sample containing yeast cells is examined they will be found as small rounded or elliptical bodies scattered through the product. Sometimes short chains composed of 2 or 3 cells may be found. When occurring in chains it is common to find the terminal cell much smaller than the others. This is the "bud" cell, which is in reality a young cell in the process of development. (Pl. XVII, fig. 2.)

BACTERIA.

Bacteria are the smallest and simplest of the organisms producing decomposition. They commonly appear as little spheres, rods, or spirals, with many intermediate forms. Some have ready means of motion, moving about rapidly in the media in which they are growing, while others are nearly or wholly destitute of this power. In some cases they produce on the surface of the food product a white or colored growth, while at other times their presence is more easily detected by the sense of odor or taste than by sight, because they are distributed throughout the decaying portion, and their presence is not so evident. It not infrequently occurs in the case of some fruits that this kind of decay is accompanied by very complete disintegration of the normal tissues, but this condition should not be confused with the normal softening of the tissues during the process of becoming overripe. A condition of overripeness greatly favors the rapid increase and development of organisms if an infection has occurred, but the softness itself may not always be due to decay. The taste and odor serve as valuable aids in judging of such conditions, and where there is doubt as to a portion being decayed the safest rule to follow is to discard it. Food products made from decayed stock caused by bacteria show these little organisms under the microscope in widely varying numbers. The rod-shaped (Pl. XVII, fig. 2) and spiral forms are most easily detected, although from the standpoint of effect on the product some of the worst forms are of the spherical type, as shown in Plate XVI, figure 2. This sample was taken from a tomato, and in a ketchup made from such stock the bacteria would be much more difficult to identify positively than those shown in figure 3.

The detection of ketchup made from certain kinds of decomposed stock is sometimes possible by a simple inspection of the bottle. Yeasts and bacteria tend to settle out in the package, and hence a bottle of such a product will show a whitish sediment, composed largely of these organisms, if it is not shaken from time to time. Tests have shown that a week is sufficiently long in some cases for such a separation to be apparent. Though a fairly good ketchup may show a slight sediment, it is one of the best crude methods by which a purchaser can obtain an idea of the character of the product. When such a sediment is present undoubtedly the product is open to criticism, although its absence is not necessarily evidence that it is clean, for two reasons: the container may not have stood sufficiently long for the separation to take place, or the decomposition may have been produced very largely by molds and these do not separate in the manner indicated. The color has also been considered of some value in judging of a product, but this can not be relied upon, since it is so largely influenced by the method of manufacture. Prolonged boiling, spicing heavily with certain dark-colored spices, or adding the sugar at an early stage in the boiling, as well as the use of certain kinds of spoiled pulp, all tend to produce a darker color. Formerly artificial color was employed by some manufacturers to overcome defects in color, but it appears that this practice has now been quite generally abandoned.

During the process of growth, bacteria give rise to many different by-products according to the variety and the conditions under which they are grown. Some give off such substances as lactic and butyric acids with the evolution of various odors and flavors. Some, as has already been noted, also produce very poisonous products. The number of organisms which occur in some products is sufficient to startle one not familiar with the subject. In ketchup made by household methods the number rarely exceeds 5,000,000 or 8,000,000 per teaspoonful of the product, or 1,250,000 to 2,000,000 per cubic centimeter, as the microscopist would state it. In a manufactured product the number is usually considerably more, but experiments conducted under factory conditions indicate that the number can be maintained at less than 100,000,000 per teaspoonful (25,000,000 per cubic centimeter). In contrast with these numbers some products have been found that were made of very poor materials in which the number of bacteria exceeded 2,000,000,000 per teaspoonful (500,000,000 per cubic centimeter). One sample of tomato paste was examined which contained 4,000,000,000 per teaspoonful (1,000,000,000 per cubic centimeter). The layman when told of such facts has sometimes expressed a naive wonder that there remained any room in the container for the product itself. To this it might be replied that some of the larger and more common bacteria are so minute that a teaspoon level full could hold more than 600,000,000,000 of them (150,000,000,000 per cubic centimeter). These somewhat crude comparisons are made for the purpose of providing some basis of comparison for those who are not microscopists. It is seen that one must know the nature of the bacteria present and also consider their numbers relatively in judging of a product. A knowledge of the rapidity with which these organisms increase and the conditions favorable to their reproduction and an appreciation of the wide difference between ordinary cleanliness and bacteriological cleanliness would go far to solve the problems of manufacturers. The use of fresh, first-class material and rapid and cleanly sorting and handling become self-evident necessities when these facts are recognized.

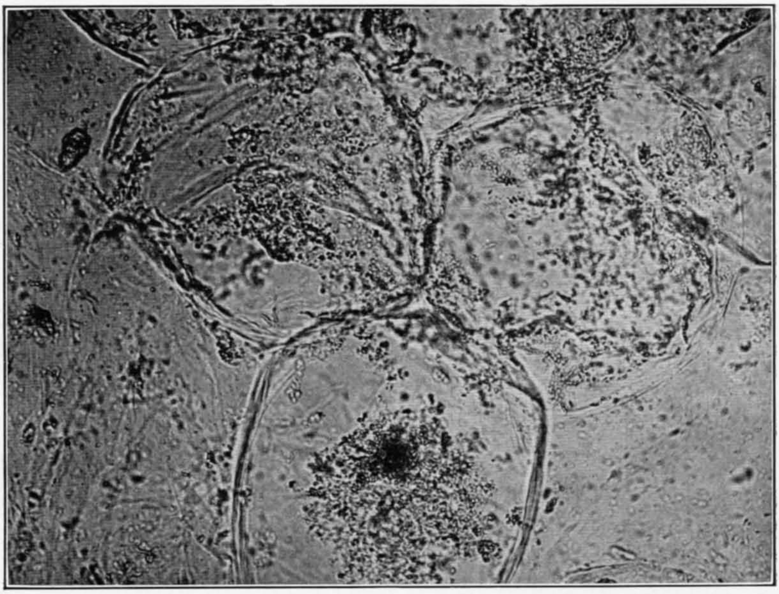

FIG. 1.—NORMAL TOMATO KETCHUP, SHOWING CELLS AND GRANULAR CONTENTS (× 200).

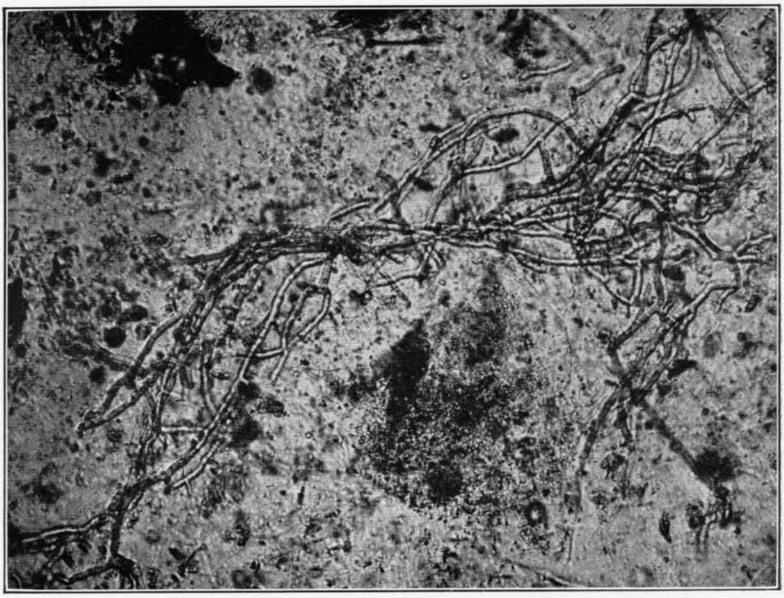

FIG. 2.—MOLD FILAMENT FROM KETCHUP MADE FROM PARTIALLY DECAYED STOCK (× 150).

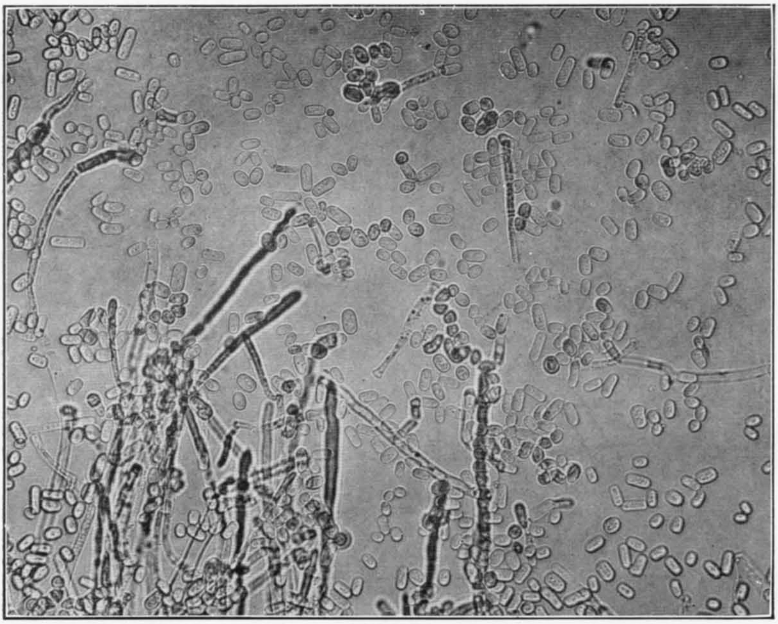

FIG. 1.—A TYPE OF MOLD, SPICARIA SP., VERY FREQUENTLY FOUND ON DECAYING TOMATOES (X 300).

[Some of the filaments and numbers of spores (oblong bodies) are shown.]

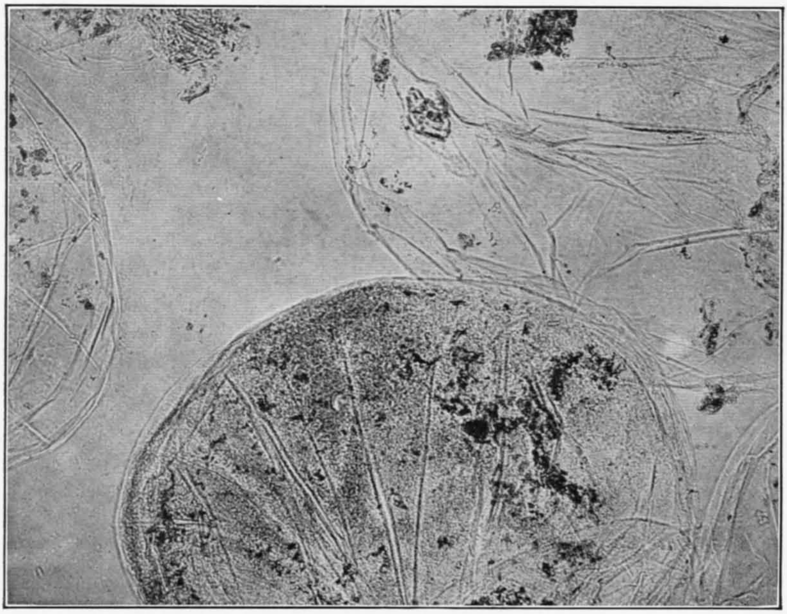

FIG. 2.—DECAYING TOMATO CELLS (X 150).

[The lower one shows cell containing a large amount of débris produced by the bacteria. giving a cloudy, granular appearance to the cell.]

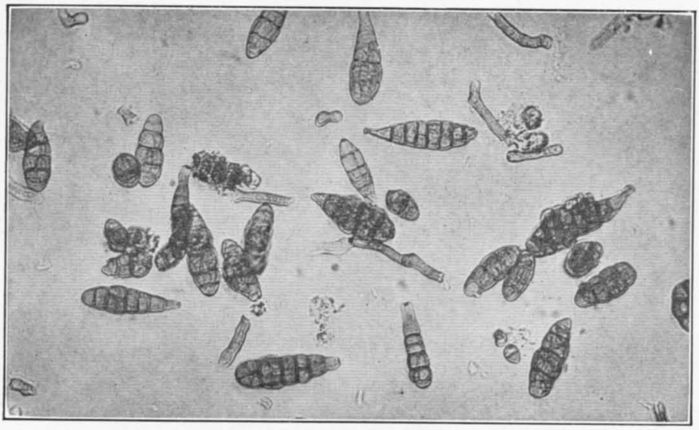

FIG. 1.—SPORES AND FRAGMENTS OF FILAMENTS OF MOLD FROM DECAYING SWEET PEPPER (X 150).

[The same or an allied species is one cause of "dry rot" in tomatoes.]

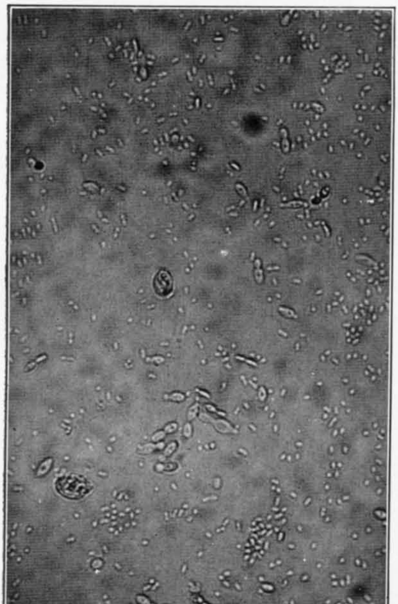

FIG. 2.—YEASTS AND SPHERICAL BACTERIA FROM DECAYING TOMATOES (X 500).

[The oval bodies are the yeasts, some in budding stage; the bacteria appear as small spheres, or pairs of spheres.]

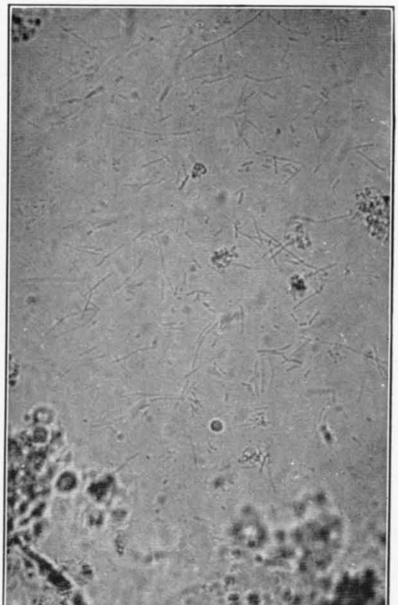

FIG. 3.—ROD-SHAPED BACTERIA FROM TOMATO PULP, COMMON IN BAD KETCHUPS (X 500).

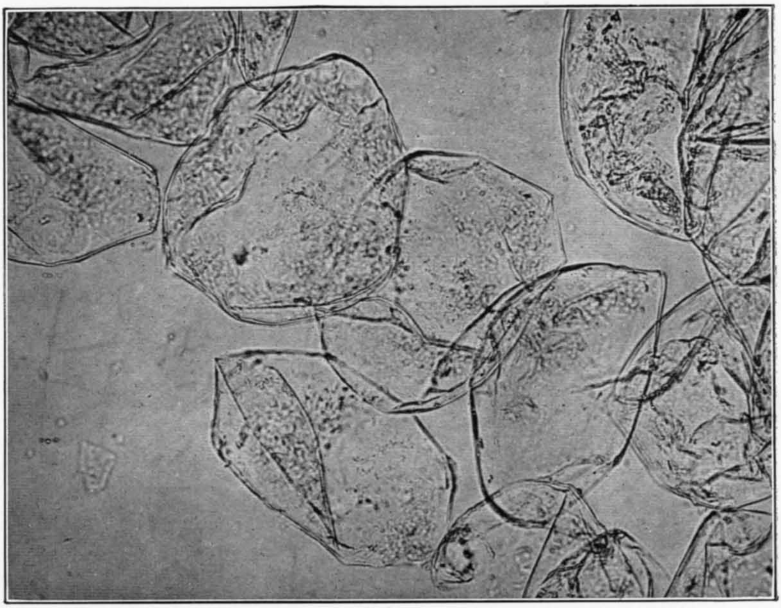

FIG. 1.—NORMAL APPLE CELLS FROM SOUND FRUIT (× 200).

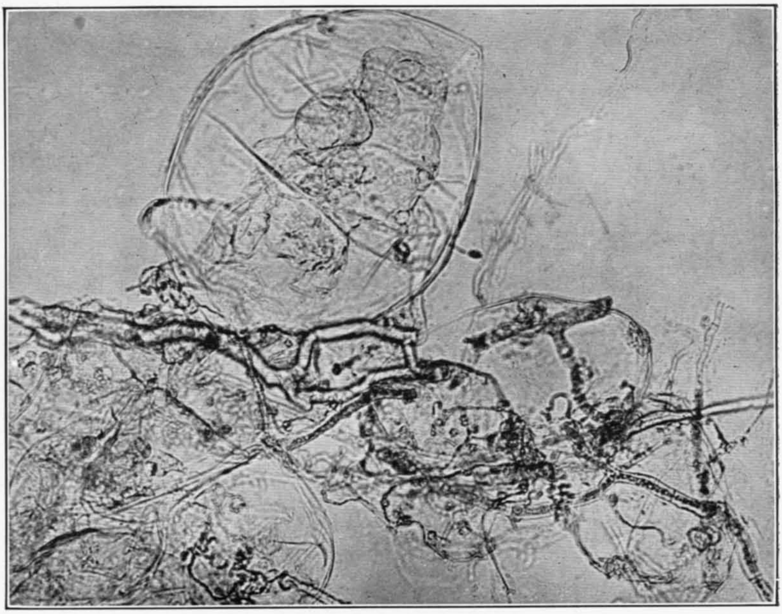

FIG. 2.—APPLE CELLS FROM DECAYED FRUIT (× 200).

[Shows infesting mold filaments.]

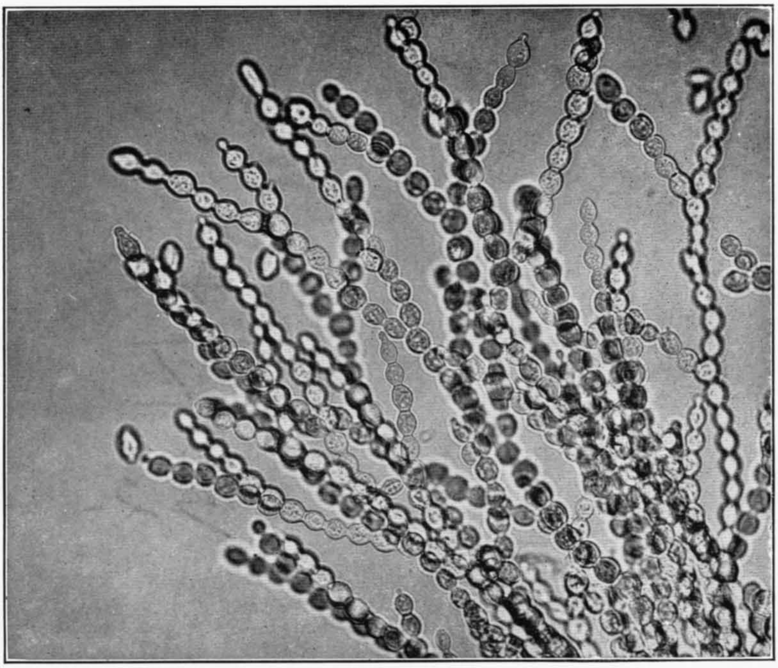

FIG. 1.—A MOLD FROM A DECAYING PLUM, PRODUCING SPORES (THE LITTLE OVAL SECTIONS); SOME IN PROCESS OF BRANCHING (× 300).

FIG. 2.—"VINEGAR EELS" FROM DECAYING BLACKBERRIES (× 75).

[Small yeast cells are also present, scattered throughout the specimen.]

ANIMAL INVASIONS.

Worms and larvæ of insects are also sometimes found in fruit products, though it can not be claimed by anyone that they are normal inhabitants. In some cases the eggs are laid in perfect fruits, and the larvæ or "worms" eat away portions of the tissues and thus make the entrance of germs an easy matter; these germs, in turn, become the immediate cause of decay. There are, however, other cases in which the female is attracted to the product and lays her eggs in the material, because of its more or less decomposed condition; this is especially true of certain flies. The fact that decaying vegetable or animal substances attract flies is a matter of common observation. Another example is observed in the case of so-called "vinegar eels" which sometimes invade strongly acid products which have been produced by bacterial decomposition. In fact, the occurrence of these worms is so associated in people's minds with vinegar that their presence has come to be regarded by some as an evidence of a good product. Such, however, is not the case, and they should rather be regarded as indicating questionable manufacturing methods. One place where they are frequently found is in decaying blackberries. They are large enough at times to be visible to the naked eye, though keen eyesight and good light are necessary. Their appearance under the microscope is shown in Plate XIX, figure 2, which was made from a sample of badly decayed blackberries.

SUSCEPTIBILITY OF DIFFERENT PRODUCTS TO DECAY.

From what has been said it is seen that decay or decomposition which may have been regarded as a simple, undesirable condition is in reality a very complex and at times a dangerous one, and the importance of the utmost care in the handling of food products to eliminate all possible sources of decomposition becomes more evident. A study of decomposition in different varieties of fruit shows that there is quite a difference between them in their susceptibility to the attacks of the organisms causing decay. Thus it has been observed that tomatoes constitute a very suitable medium for a large variety of organisms, and as a result the flora producing decay in this fruit and its products is a varied one. On the other hand, apples are more apt to be attacked by molds. Among berries it has been observed that blueberries and blackberries are especially susceptible to invasions by yeasts and certain acid-producing bacteria, while the molds, because of the character of the fruit, are very largely held in check. And so examples might be multiplied, but these serve to show that different fruits vary as to their susceptibility to certain kinds of decay, and in considering this question it is important that a study be made of each kind of fruit before strict limits can be fixed with which the products must comply. It is also seen that to obtain an accurate understanding of the question a large amount of experimental work is necessary, not only in the laboratory but also in places of production and in factories.

ORGANISMS THAT MAY BE PROPERLY PRESENT.

In the microscopic examination of fruit products, traces of molds, yeasts, and bacteria can almost always be found even in the most carefully prepared products and in moderate numbers should not be regarded as objectionable. When, however, their number exceeds what experience has shown is to be expected in products made from sound material under careful sanitary conditions, one's suspicions are properly aroused. As has already been noted, tests made on homemade products and manufactured goods have usually shown that the products put up by regular household methods contain markedly fewer organisms than even an acceptable factory product.

This brings us to another phase of the question, namely, that certain food products depend for their individual character upon the action of some certain kinds of organisms. The so-called curing to which certain food products are subjected produces in them changes in composition and character which, in a strict interpretation, might be considered as forms of decomposition. Such changes, however, are to be clearly differentiated from uncontrolled decomposition and decay, and such has been the opinion handed down by certain of the Federal courts which have considered these points. A well-known instance of this kind is exhibited in the manufacture of kraut. In this case a lactic-acid fermentation is produced in the chopped cabbage and an essentially new product results. To produce it the cabbage is prepared in a careful manner, a certain amount of salt added, and the growth of the lactic-acid bacteria induced. Such a change, and virtually no other, is desired. A microscopical examination of the product reveals the presence of a large number of lactic-acid bacteria, and a marked change also results in the chemical character of the cabbage by the production of lactic acid. It sometimes happens, however, that, due to one cause or another, certain wild putrefactive bacteria gain a foothold and produce an exceedingly undesirable change. The product then becomes very different in character, and the whole may become a partial or complete loss, for it obviously is no longer entitled to be termed "kraut," by which is meant a certain kind of product fermented by a certain organism. In a similar way, cases might be cited in the manufacture of various cheeses, wines, vinegars, and some pickles. Thus the characteristic flavors produced in different kinds of cheeses are influenced as much perhaps or even more by the kind of organisms employed in the ripening process as by the kind of milk or method used in manufacture. The use of such selected organisms for the production of different flavors in a product is plainly an entirely different proposition from that of the presence of wild, undesirable organisms indicating uncleanliness, deterioration in flavor and appearance, or unhealthfulness.

ECONOMIC CONSIDERATIONS.

It is evident that the elimination of decomposed materials from stock used for manufacturing purposes has an important economic aspect as well as an ethical or hygienic bearing, since it means utterly discarding stock which previously was used by some manufacturers. Such material, whether in the raw or in the partially manufactured condition, when it reaches the final stage of manufacture has depreciated in value. If the ultimate consumer always knew of its true character it is probable that this depreciation would be still greater, for there would be practically no demand for such goods. The manufacturer realizes the truth of this when he so often puts the sound, firm strawberries into his preserves or canned stock, while the more or less decayed fruit is carried away and barreled, to be made into "jam" after the rush of the canning season is over. It also explains, in fact, why canned or preserved peaches run low in the number of organisms present, while "peach jam" and "peach butter" sometimes contain numbers out of all relation to what is found in sound products. In one case the consumer can see it and would refuse the decomposed product, while in the other instance the appearance of the product would not lead the buyer to be suspicious of it. The farmer realizes this when he selects all sound tomatoes to offer to the housewife at the city market, but puts in everything that has a ghost of a chance of passing muster when they are to be shipped to a canner or packer. There is a difference in price, someone says. Very true, because of the tendency to try to use more or less questionable raw stock, as well as the fact that so large an amount has to be discarded, the buyer pays less, while this fact and the very acceptance of such goods lead the producer to be more careless in the matter of properly harvesting and marketing his product. Thus an undesirable condition all round is established, whereas if the buyer would pay a better price he could demand a higher grade article and so decrease his losses that an ultimate saving would be effected, to say nothing of the advantage to all those handling and consuming the product and the reputation established for a sound output. The writer has seen tomatoes delivered at factories where the loss, due to decay in preparing them for packing, amounted to nearly 33 per cent, and in some of these cases it was a total loss to the packer, as it all went to the dump. A large part of this loss would have been avoided if the tomatoes had been picked when in the proper condition and then delivered promptly.

It not infrequently happens that because of the slight increase in cost which more frequent picking would entail some of the farmers in a community allow too long a time to elapse between successive pickings. This results in many of the tomatoes which were underripe at one picking becoming overripe and possibly partially or wholly decayed by the next one, and, furthermore, too long a time may elapse between picking and delivering. This results in reality in a loss to the producer, in that he may find it necessary to discard some of his product in the field; or, on the other hand, the manufacturer may receive deliveries of doubtful character and suffer a greater loss because of the culling to which they must be subjected. In such a case the loss indirectly falls back on the producer, for the manufacturer in making purchases is compelled to calculate on a greater amount of waste, and consequently scales down the price he might pay for sound stock. It is self-evident that the manufacturer can not afford to pay as high a price for raw stock, in which his loss due to decay will be 20 per cent, as he could if it were not over 1 or 2 per cent. Educational campaigns along this line on the part of progressive farmers and buyers in the different localities would unquestionably result in bettering conditions for all concerned and make the return for the total crop greater than under the present system. We are, therefore, forcefully impressed with the importance of the proper handling of the product all along the line from the producer of the raw material, through the hands of the manufacturer, during storage and transportation, and even after it reaches the consumer.

To efficiently solve the problem the method of handling some products must be changed, since under present conditions it is practically impossible in some cases to get them to market in proper condition. In such an event it may be necessary to pack the product nearer the source of supply, instead of depending upon raw material that has spent a sufficiently long time in transportation to allow a more or less advanced state of decomposition to occur. The question of handling, from producer to consumer, is therefore of primary importance, as well as the methods of manufacture; in fact, the two problems are so closely related that no solution is practicable that does not consider both factors.

POSSIBILITIES AND NEED OF SUPPLEMENTAL IRRIGATION IN THE HUMID REGION.

By Milo B. Williams,

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THE PRACTICE OF IRRIGATION.

Irrigation was first practiced in the more arid portions of this continent. Traces of the crude irrigation systems of the Aztecs are to be found in what now constitutes the southwestern part of the United States, and Coronado, Espejo, and other Spanish explorers and their followers, in the valley of the Rio Grande in New Mexico, replenished their store of food supplies from the irrigated crops of the Pueblo Indians.

Three centuries later the same practice was adopted by the Anglo-Saxon race in the settlement of parts of the Rocky Mountain region. The pioneers in the Salt Lake Valley of Utah found that neither wheat nor potatoes would grow until the dry soil was moistened by turning the waters of some mountain stream upon it. Other bands of pioneers who formed settlements at the base of the Rockies in northern Colorado, on the banks of the West Gallatin River in Montana, and along the Humboldt River in Nevada had a similar experience. In this way the practice of irrigation spread throughout the richer and warmer valleys of the arid portion of the West, and for more than half a century all the more valuable crops of these regions have been artificially watered. As a result the people of this country have come to associate the practice of irrigation with the growing of crops in localities where the scanty rainfall produces only desert plants.

Agricultural development in the West, however, has not been confined to arid conditions alone. There was much land which, while arbitrarily classed as "arid," produced good crops while the soil was still virgin. This was particularly true of the great central plain of California, which for many years was one of the greatest wheat regions of the United States, although over much of it the annual precipitation is less than 20 inches. The continuous production of wheat, however, greatly reduced the yield, and the landowners have been obliged to irrigate in order to grow more valuable crops. Similarly, over the semiarid belt which extends from the Dakotas on the north to the Panhandle of Texas on the south the need of irrigation is becoming more and more keenly felt, and every year sees larger areas provided with an artificial water supply.

In more recent years the practice of irrigation has also been extended to the production of rice in the Gulf States. Louisiana, Mississippi, southern Arkansas, and western Texas have a heavy rainfall, but their rice fields must receive on an average from 18 to 24 inches of irrigation water in addition to mature the crop.

The purpose of this article is to show not only the possibility but the need of supplemental irrigation in the growing of the more valuable crops throughout many portions of the humid region.

THE RELATION OF RAINFALL TO IRRIGATION.

A climate having an annual rainfall of 20 inches or more is generally regarded as humid, for where this amount of rain is fairly well distributed throughout the year arable land can usually be farmed. This measure of aridity divides the United States into two nearly equal parts, east and west, marked by a belt of semiarid country located near the ninety-ninth meridian. Although this division is based upon the moisture supply of the climate, it is not a true index of the need of irrigation, as many sections having an annual rainfall of more than 20 inches do not during the growing season receive a dependable precipitation sufficient for farming purposes. Rains must come at such times and in such amounts as will properly moisten the soil for the preparation of the seed bed and will furnish a reasonably constant supply of moisture to germinate the seed and develop the plant until it reaches maturity. A check in this supply of soil moisture at any stage of the growth affects the quality and quantity of the yield and may greatly reduce the profits of the grower. The real test of what is a humid section is therefore not the total annual rainfall, but the monthly, and, in the case of many plants, the weekly amount during the growing season. Viewed in this light, irrigation becomes a National need rather than merely a western practice.

SUPPLEMENTAL IRRIGATION AS AN INSURANCE.

There is perhaps no other industry so broad or so varied as farming. No manufacturer encounters so many uncontrolled elements and no factory output is so delicate or perishable or its market so uncertain as that of the farmer. One of the main advantages of farming under irrigation is that the water supply needed for the growth of crops, which is one of the most, if not the most, uncertain factors in other farming, is very largely under the control of the grower. This advantage, however, has hitherto scarcely been grasped by the farmers in the humid section, and few realize that with a small outlay an irrigation plant can be installed which will insure them against complete or partial crop failures during droughts.

Farming conditions, however, have greatly changed in recent years. The soils in many localities no longer produce profitable yields without the application of artificial fertilizers; the value of farm lands has greatly increased; farming methods are more intensive; more valuable crops are being grown; and consumers are demanding a greater variety, a better quality, and a more constant supply of delicate farm products. Thus, the farmer of to-day is obliged to expend a large amount of money to produce a crop, and if for any cause this crop is a failure his losses are greater than in the past. The wheat grower of Kansas may produce a crop at an average cost of $10 per acre, while the citrus grower of southern California is obliged to spend $400 per acre in growing and marketing a crop of navel oranges. To insure the wheat crop against a possible drought might not pay, while to insure the orange crop is an absolute necessity, for if the pumping plants which raise water from the bed of the Santa Ana River for the orange orchards of Riverside, Cal., were to be shut down that region would in time revert to a desert. Although the annual precipitation in the citrus regions of Florida is 55 inches, while that at Riverside is only 10.74 inches, one should not conclude that irrigation is not necessary in the former, as there are periods when less than 1 inch of rain falls in 30 days, and at such times the application of a small amount of water may be followed by as good results as at Riverside.

Under average conditions it is safe to say a drought occurs whenever the precipitation in any 15-day period falls below 1 inch. It has been the writer's observation that crops will usually suffer if they do not receive considerably more than this amount of rain, especially during the spring and early summer months. Later in the season this quantity may not be needed, excepting for late garden truck and some fruits. The following table, compiled from rainfall records of the Weather Bureau taken at representative points in the humid region during 10 growing seasons, 1900 to 1909, inclusive, shows the average annual rainfall, the number of periods of 15 days or more with less than 1 inch of rainfall, and the total number of days in the 10 years that droughts extended over the 15-day periods:

Average annual rainfall, number of droughts, and number of days when irrigation was required at representative points in the humid region during the growing seasons 1900–1909, inclusive.

Stations.	Average annual rainfall.	Number of 15-day periods or over with less than 1 inch of rain.	Number of days when irrigation was required.[1]
	Inches.		
Ames, Iowa	30.39	23	190
Oshkosh, Wis	29.78	27	292
Vineland, N. J	47.47	46	352
Columbia, S. C	47.55	62	568
Selma, Ala	50.75	60	724

[1] No days counted till after a 15-day period with less than 1 inch of rain.

POSSIBILITIES IN DIFFERENT SECTIONS.

For convenience in describing the possibilities and advantages of irrigation in the different parts of the humid section the States therein have been divided into three groups, viz, North Central, North Atlantic, and Southern States.

NORTH CENTRAL STATES.

The group known as the North Central States comprises that portion of the United States bounded on the north by the Great Lakes and Canada, on the west by the Missouri River and the Dakotas, and on the east and south by the Appalachian Mountains and the Southern States, and includes the first northern agricultural States which are considered entirely humid in comparison with States in the West. The prairie States of Iowa, Illinois, Ohio, and Indiana are probably the most favored States in the country from an agricultural standpoint, as they receive an abundant and very even distribution of rainfall during the growing season and have soils rich in humus, which, when properly cultivated, retain the moisture well. Common field crops are grown and used principally for the production of live stock and dairy products. Short droughts do not affect such crops to the same extent as the more delicate fruit and vegetable crops, and pastures and forage crops are probably the crops most affected by droughts in these States.

The normal annual rainfall at Ames, Iowa, is 30.4 inches, and the growing season of Iowa extends approximately from April 1 to October 1. During the growing seasons, 1900–1909, inclusive, there were 23 periods of 15 days or over with less than 1 inch of rainfall. Ten of these dry periods occurred in the months of April and May, the most critical time of the year, but none lasted over 25 days, and therefore it is probable that no serious damage was done except to garden truck, pastures, and lawns, save when two or more droughts came near together. Six droughts, including the one with the greatest duration, 52 days, came in the summer months. It was noted in the study of the daily rainfall at the Ames station that a large number of small showers generally came during these deficient periods. Although these showers did not wet the soil deeply, they tended to keep the air humid and to check evaporation losses. Assuming that irrigation would be beneficial to Iowa crops after 15 days have passed with less than 1 inch of rainfall, there were 190 days during the 10 growing periods when supplemental irrigation could have been used to advantage.

The possibilities of irrigation in Michigan, Wisconsin, and the northeastern part of Minnesota are much greater than those of the States bordering them on the south. The upland soils are a mixture

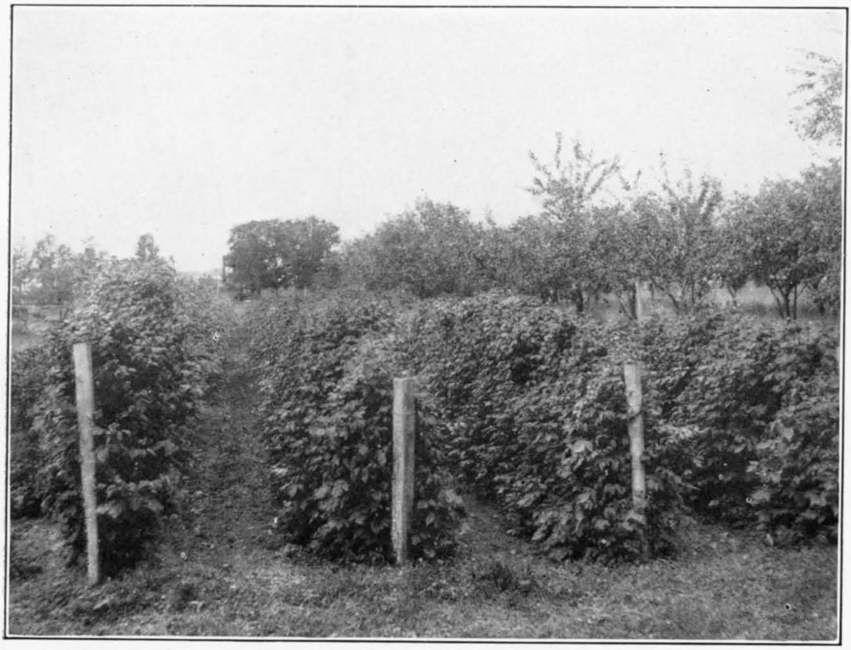

FIG. 1.—IRRIGATED RASPBERRIES AT NEENAH, WIS.

FIG. 2.—STRAWBERRIES IRRIGATED BY SPRAY SYSTEM, RANCOCAS, N. J.

FIG. 1.—SUBIRRIGATION OF CELERY AT SANFORD, FLA.

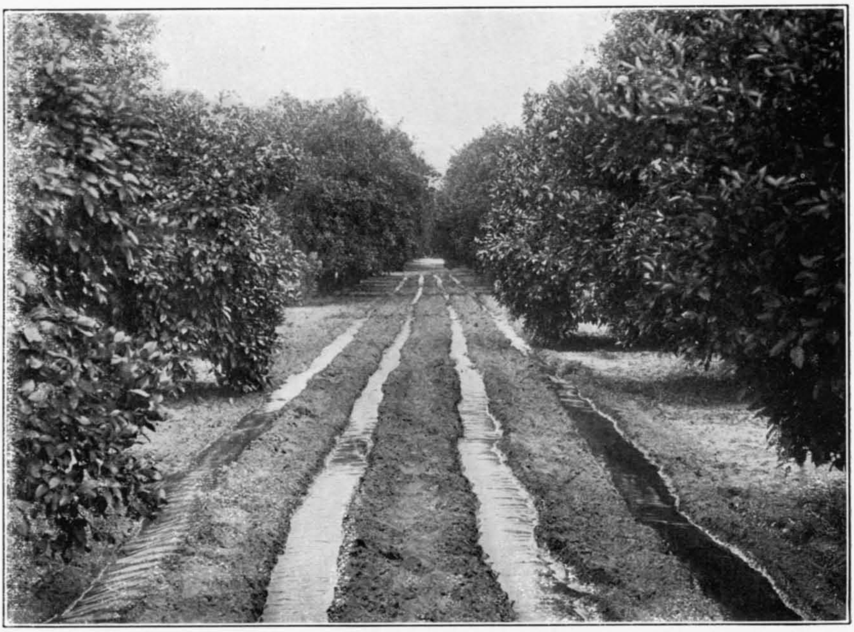

FIG. 2.—IRRIGATED CITRUS GROVE, ORLANDO, FLA.

of coarse and fine glacial materials, porous and nonresistant to drought, yet responsive to tillage and adapted to the growing of garden truck, berries, hardy fruits, hay, legumes, and sugar beets when moisture is applied. The lowland soils are sedimentary and vary in texture from heavy loams to porous peat. When thoroughly drained these soils are adapted to the growing of many of the most valuable crops. The wet condition before drainage does not indicate that the soils are immune from drought. Irrigation and drainage must go hand in hand to insure the greatest returns.

The water resources of these States are most abundant. Hundreds of lakes, large and small, afford the possibility of constant supplies for wilting crops in dry weather. Creeks and small rivers abound with opportunities for the installation of small pumping plants at the margins of fields.

The northern climate demands a hardy type of farming. The growing seasons are short and the winters cold and bleak. These climatic conditions make it all the more necessary for the farmer to grow his crop without delay or setback. Late planting caused by a dry spring may result in the crop being frozen in the fall before it is matured. In the spring of 1910 Wisconsin experienced a drought which did great damage in the garden sections. Fields prepared for the setting out of plants stood idle for weeks waiting for a rain to supply the necessary moisture, and when the rain came, at a late date, plants were rushed in on large acreages. This resulted in the maturing of many crops at the same time and caused a flooding of the markets and a lowering of prices to an unprofitable figure. A later drought the same season caused a celery crop, valued at $1,000 per acre, growing on peat lands near Waupaca, Wis., to develop seed sprouts, which ruined the crop. An abundant water supply was within a few feet of the surface and a pumping plant could have been installed and the crop irrigated with the profits that would have been realized from 1 acre.

On the other hand, 1½ acres of irrigated strawberries at Neenah, Wis., yielded berries valued at $200 after the unirrigated vines in the same field had stopped bearing. An onion crop grown under irrigation in the same locality yielded 483.8 bushels per acre, and the onions took first premium for quality at the Winnebago County fair. This crop was irrigated six times during the months of June and July and received 3.04 inches of water by irrigation and 5.77 inches by rainfall. This seemingly large amount of water was made necessary, as most of the rain came in one large storm and the balance in 11 small showers, none of which moistened the soil to a sufficient depth.

The four rows of raspberries shown in Plate XX, figure 1, were irrigated at Neenah, Wis., by running water in furrows between the rows two or three times each season for the past two years. In 1910 berries were picked from the vines 10 days longer than from unirrigated plats, and a marked improvement was noted in the quality of the berries and the thrift of the vines. The grower of these berries has also practiced furrow irrigation in an old apple orchard. The orchard has borne fruit three years in succession, with a maximum yield in 1910 of 1,149 bushels on 3½ acres. The fruit was all sold locally before November for $1 to $1.50 per bushel.

The annual rainfall for northeastern Minnesota, Wisconsin, and Michigan ranges from 30 to 45 inches. Assuming that the growing season of these States extends from April 1 to October 1, Oshkosh, Wis., had in the 10 growing seasons, 1900–1909, 27 periods of 15 days or over with less than 1 inch of rainfall. Sixteen of these periods, including the one with the greatest duration, 59 days, came in the spring and early summer months. Seventeen droughts were 20 days and over in duration and injured nearly all Wisconsin crops. Considering irrigation beneficial to Wisconsin farming after 15 days have passed with less than 1 inch of rainfall, there were 292 days in the 10 growing seasons during which supplemental irrigation was needed.

THE NORTH ATLANTIC STATES.

The States bordering the Atlantic Ocean from Maine to Virginia include a narrow strip of agricultural country wherein great possibilities seem to exist for that intensive type of farming to which supplemental irrigation is adapted. Here are to be found perhaps the best markets in the world for farm products. Three hundred years of colonization have dotted this land of our forefathers with many large cities, but with few up-to-date farming communities. Many thousands of acres of virgin lands still lie idle awaiting the time when they will be reclaimed by scientific farming and moisture control. The greatest demand made by the markets upon agriculture in this region is for food crops for human consumption. Great areas are adapted to the production of these crops, and probably some of the most suitable lands are untouched by the plow because of their lightness of soil and nonresistance to the effects of drought.

The Atlantic slope is well supplied with water resources for irrigation purposes. The bulk of the agricultural lands touches the streams farther downstream than where the streams are needed for power and domestic uses. Many springs and underground supplies can also be developed and conserved for times of need.

The climate of these States is tempered sufficiently by the ocean to give longer growing seasons than are found in the North Central States, thus enabling early summer and late fall vegetables to be raised with irrigation, and all tree fruits, from the northern apple to the temperate peach, thrive under care. Soil-improving legumes can also be grown in the sterile, tillable, sandy sections if moisture be assured.

New Jersey, with an average annual rainfall of approximately 45 inches, is typical of the North Atlantic States. Assuming that the growing season extends from March 1 to November 1, there were at Vineland, N. J., in the 10 growing seasons, 1900–1909, 46 periods of 15 days or over with less than 1 inch of rainfall. Twenty-eight of these, including the one of greatest duration, 52 days, came in the spring and early summer. Valuable annual fruit and field crops are affected by the early drought, as well as the quick-growing early truck crops.

Assuming irrigation beneficial to this section after 15 days with less than 1 inch of rainfall, there were 352 days in the 10 growing seasons when supplemental irrigation was needed. During a New Jersey drought in the spring of 1911 the early strawberry crop in many sections was completely ruined. The value of this one year's crop would have paid the farmers affected thereby 250 per cent interest on a most expensive spray irrigation system. The irrigation of later strawberries under the plant shown in Plate XX, figure 2, increased the value of the yield $100 per acre and left the plants in a sturdy condition for future bearing. The yield of alfalfa at Vineland, N. J., was increased by irrigation during the season at the rate of 2 tons of cured hay per acre, worth $20 per ton in the field.

THE SOUTHERN STATES.

The Southern States east of Texas and bordering on the Gulf of Mexico and the Atlantic Ocean cover one of the richest areas of undeveloped agricultural wealth in the United States. Nature has blessed this region with long growing seasons and an abundant water supply, which, if evenly distributed, would make this one of the garden spots of the world. Up to the present, cotton and corn have been the principal crops. In 1900 the average size of the farms in the South Atlantic States was 108 acres; in 1910 it was 93 acres. During the same period the expenditures for fertilizers increased from $2,733,000 to $59,492,000.[1] If the use of fertilizer may be regarded as an index these facts show a tendency toward smaller holdings and more intensive farming. The soils of the South are as a rule porous and easily worked, but lack fertility. The fertilizers which are applied to make up for this deficiency often either lie inert during drought or are leached out by torrential rains. The annual rainfall varies with the locality from 45 to 55 inches. This insures an abundant water supply if properly conserved. There are also many artesian basins, where good wells of large capacity can be

[1] Census returns for 1910.

obtained for irrigation. The climate of these States is temperate at the north and semitropical at the south. Florida produces the most delicate fruit and vegetable crops in the dead of northern winter, and the neighboring States can produce as valuable crops in the early spring. Intensive farming usually has been hampered by the uncertainty of the spring rainfall, and irrigation is needed to insure a more constant supply of soil moisture. Rains come in torrential storms, which dissipate their waters in surface run-off. Droughts follow, with intense heat at critical periods of the plant's growth. Over the greater part of this entire region the summers are wet, the winters dry, and the rainfall of the spring and fall months is uncertain.

Assuming that the growing season of the Southern States, exclusive of Florida, extends from March 1 to December 1, there occurred at Columbia, S. C., in the 10 growing seasons, 1900–1909, 62, and at Selma, Ala., 60 periods of 15 days or over with less than 1 inch of rainfall. The greater number of these droughts, together with those having the greatest duration, came in the spring and fall months, with 10 or 15 scattered throughout the summer seasons. It is not uncommon to have the droughts materially affect the resistant crops of corn and cotton in this region. Considering irrigation beneficial to the South after 15 days have passed with less than 1 inch of rainfall, Columbia, S. C., needed supplemental irrigation 568 days, and Selma, Ala., 724 days in these 10 growing seasons.

The semitropical climate of Florida gives rise to agricultural conditions existing in no other humid State. No Eastern State receives the same amount of winter sunshine and none has so large an annual precipitation. Truck lands which need drainage in the summer need irrigation in the winter, and an effort to combine the two processes in the one plant has been quite successful. This has brought about the extensive adoption of subirrigation (Pl. XXI, fig. 1).

A combination of irrigation and drainage at Sanford, Fla., has transformed worthless lands into those producing crops of celery valued at $2,000 per acre for one crop. Irrigation of the uplands of this State shows similar results in citrus culture. Florida citrus fruits ripen and bud in the dry season. Irrigation is needed and applied with profit to insure the best maturing of these fruits and a prolific setting of buds for the next year's crop (Pl. XXI, fig. 2).

Irrigation at Albany, Ga., has made it possible to produce an abundant growth of alfalfa on worn-out cotton lands. Irrigated corn gave a yield three times as large as that in surrounding fields. The waters of a flowing well near Selma, Ala., which have been wasted for 40 years, have converted portions of a worn-out plantation into a productive garden. In this locality valuable food crops can be grown for 9 months each year by the introduction of scientific crop rotation insured by supplemental irrigation.

METHODS OF IRRIGATION IN THE HUMID REGION.

The trend of irrigation in this country has been from the west toward the east—from the arid to the humid regions. Conditions which affect the practice of irrigation differ so widely in the two regions that the methods followed in the West can not, as a rule, be adopted in the East without modifications. In the West it is common for a number of individuals to unite in the construction and operation of an irrigation system designed to serve the needs of all the stockholders; in the East irrigation plants are installed usually by individuals without cooperation. In the East it is also almost impossible to develop great water resources and appropriate their use for irrigation purposes because of the conflicting interests involved, the vested rights of other industries, and the fact that the laws of the Eastern States give irrigation but little, if any, consideration in the diversion of stream waters. Lastly, irrigation is not sufficiently vital in the East to impress all farmers with its value, and many crops covering large areas will continue to be grown without irrigation, the returns being considered too low to justify the expense of providing an artificial water supply. As a result of these conditions irrigation in the humid region will be confined to small units undertaken by individual farmers.

WATER SUPPLIES.

Notwithstanding the fact that large water supplies can not be utilized for irrigation purposes, the eastern farmer has available many smaller supplies which may be developed cheaply. Streams varying in size from creeks to large rivers are usually available for pumping purposes for considerable distances after their beds cease to have sufficient fall to develop power. Ponds and lakes have few other uses than for irrigation. Many of the creeks in the farming districts which flow only periodically can be made to supply many acres by damming up and storing the run-off. Storage will also conserve water from springs, flowing wells, and pumped wells until it is needed during dry weather.

Much of the water used in irrigation in the humid region will have to be placed on the lands by means of pumping plants, and great care should be exercised in the design and installation of such plants in order to insure efficiency and to have them adapted to the various agricultural conditions and methods of water distribution.

SURFACE IRRIGATION.

Surface irrigation is the standard method of water distribution in the fields of the arid region. It can not, however, be so readily adopted in the humid regions. In many cases it is not desirable to change regular-shaped fields and long rows to irregular ones con-forming to topographical features. In other cases it is impossible to grade the lands without destroying the even distribution of shallow soils and causing injury to the land. Again, many intensively cultivated and valuable crops are grown too thickly on the surface of the ground to permit the running of water between the plants. Notwithstanding the above objections, there are many fields in the humid regions which can be most economically and efficiently irrigated by a surface method. Water can be flooded over the surface of naturally level fields or lands having continuous even slopes. Cultivated row crops on such fields can be irrigated by running water in small furrows between the rows. Lands adapted to easy furrow irrigation can generally be surface irrigated when in a forage crop, if prepared before seeding by dividing the fields into level squares or gently sloping long units, so that a thin sheet of water can be flooded over a unit at a time.

SUBSURFACE IRRIGATION.

There are areas in the humid regions where subsurface irrigation through underground tile or pipe can be practiced. (See Pl. XXI, fig. 1.) Subirrigation requires certain peculiar underground conditions to be successful, and the farmer should make a careful examination of such conditions before adopting this method. Level lands having a shallow, porous surface soil overlying an impervious substratum are best suited to subirrigation. Only shallow-rooting crops can be grown without danger of the root fibers stopping up the tile. Subirrigation also is not practicable except for crops that will pay interest upon a system costing $100 or more per acre.

A type of subirrigation may be practiced in connection with certain drainage systems by incorporating within the drainage construction controlling devices for checking the flow of water in the tile in times of dry weather. The drainage of all lands upon which valuable crops are raised should be designed with subirrigation in view.

SPRAY IRRIGATION.

The process of applying water to crops by distributing it through the fields under a pressure which will spray it into the air and let the moisture fall like a gentle rain has great possibilities in the humid region. The system is adapted to any crop of sufficient value to justify the cost of installation where the type of farming followed or the natural conditions prohibit the efficient use of a cheaper method. (See Pl. XX, fig. 2.) A spray system will distribute water evenly over the surface of rough or rolling lands, regardless of soil or underground conditions. Crops completely covering the ground can in this way be irrigated without damage. Spray irrigation is also well adapted to those humid conditions which demand small and frequent applications of water in the preparation of the soils for setting out young plants and keeping them thriving through a dry spell, or for softening the surface to aid in weeding and cultivation.

POSSIBILITIES AND NEED OF IRRIGATION EAST OF THE MISSISSIPPI.

The investigations and experiments of the Office of Experiment Stations, of some of the experiment stations, and of progressive farmers throughout the humid region have demonstrated that the possibilities of irrigation are numerous and the need urgent in the region east of the Mississippi River. Some of the facts ascertained by these investigations and experiments are summarized as follows:

(1) Unlike the trend of development in other lines of agriculture, the practice of irrigation originated in the West and has progressed eastward. From being confined to the strictly arid portion of the United States, it has spread to the semiarid, and finally to the humid portions of the country. The good results which have followed the use of water in such valleys as the Sacramento, of California, and the Willamette, of Oregon, where little rain falls during the summer months, convinced those living farther east that the use of a little water artificially applied during droughts might also be as beneficial.

(2) In a majority of years nearly all sections of the humid region are visited by one or more dry periods of sufficient length to damage crops, especially truck and berries and other small fruit. The normal annual precipitation of Columbia, S. C., is 47.55 inches, yet in 10 growing seasons, from 1900 to 1909, inclusive, 62 droughts occurred in this vicinity. Twenty-seven of these lasted between 20 and 30 days, 4 between 30 and 40 days, 6 between 40 and 50 days, and 1 had a duration of 61 days. When one assumes that water may be advantageously applied when less than an inch of rain falls in a 15-day period there would thus be, on an average, 56 days during each growing season when irrigation water might be beneficially applied in this part of South Carolina.

(3) The annual rainfall for Minnesota, Wisconsin, and Michigan ranges between 30 and 45 inches. Assuming these States to have a growing season extending from the first day of April to the last day of September, Oshkosh, Wis., experienced in 10 growing seasons 27 droughts having durations of 15 days or over, when less than 1 inch of rain fell. Sixteen of these dry spells came in the spring and early summer, one of which lasted 59 days.

(4) The normal annual rainfall of New Jersey is about 45 inches, and this is typical of the North Atlantic States; yet during the growing seasons of 10 years this section has experienced 46 droughts, with durations ranging from 15 to 52 days. Twenty-eight of these were spring and early summer droughts, the most damaging to all crops.

(5) In the States bordering the Atlantic farming conditions have greatly changed in recent years. A larger quantity of artificial fertilizers is required for the worn-out soil. The value of farm lands has greatly increased, higher-priced crops are grown, more intensive cultivation is practiced, and consumers are demanding a greater variety and more constant supply of fruit and vegetables.

(6) It has been demonstrated that irrigation is profitable for such crops during long-continued dry spells in all parts of the humid region, including the citrus fruits of Florida.

(7) There are but few years when increased yields for such crops as strawberries, celery, etc., would not pay the interest on the first cost and the depreciation on an irrigation system, and in such years as 1910–11 the yields for a single year might be sufficient to pay for the entire system.

(8) The nearness to markets, the high-priced crops raised, the large expenditures necessary for fertilizers, labor, etc., the smaller area farmed per man, and the higher land values in the humid region, justify the expenditure of a considerable sum per acre for installing a system to insure high-price crops against periods of droughts.

(9) The greater range of climatic conditions, soils, crops raised, sources of water supply, and the high cost of installing an irrigation system in the East render it necessary that each farmer carefully study his own conditions before deciding what method of applying water he will use. These also render it advisable in most cases to begin irrigating on a small scale and gradually increase the area.

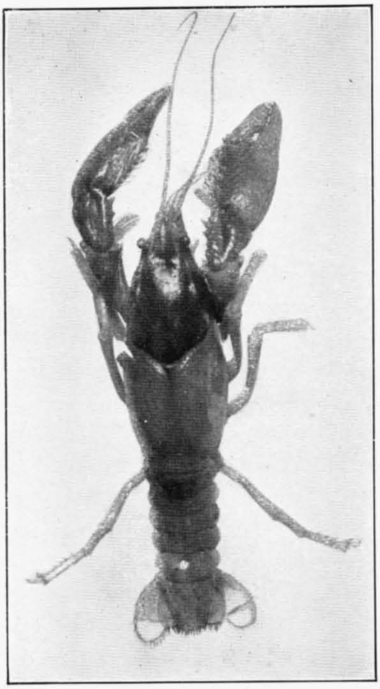

FIG. 1.—CROP-DESTROYING CRAWFISH (THREE-FOURTHS NATURAL SIZE).

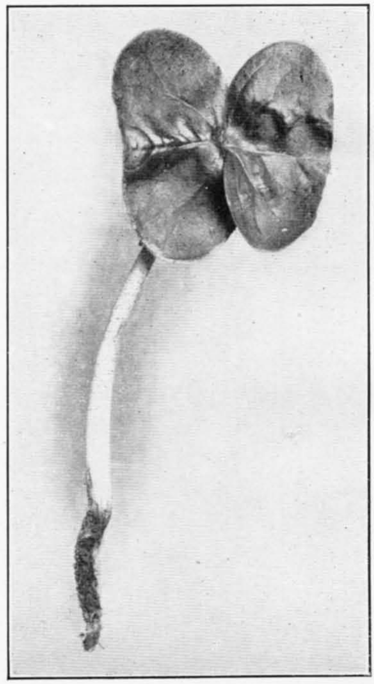

FIG. 2.—COTTON PLANT IN STAGE WHEN MOST LIABLE TO ATTACK BY CRAWFISH (NATURAL SIZE).

FIG. 3.—COTTON FIELD DAMAGED BY CRAWFISH AFTER THREE PLANTINGS.

CRAWFISH AS CROP DESTROYERS.

By A. K. Fisher,
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In all lands wild animal life abounds, and as soon as the agricultural development of a region is begun, many species quickly assume beneficial or injurious relations to the growing crops. In the United States we have learned by bitter experience to recognize certain noxious species and to adopt more or less effective methods for their control. At times, however, we are confronted by the injurious activity of a species hitherto comparatively harmless to agriculture. Such species may be importations from foreign countries or from other States, or they may long have been residents of the areas where they develop noxious habits. A notable example of the latter class is a large parrot which, after the introduction of sheep into New Zealand, assumed the rôle of a bird of prey, gradually abandoning its normal food of wild fruits to feed on those helpless animals. It alighted on the sheep, tore great holes with its powerful beak, and ate the kidneys and succulent muscular tissues. Within the United States, meadow mice, which are of little economic importance in wild lands, have at times suddenly increased inordinately and have invaded extensive agricultural areas. In 1908 thousands of dollars' worth of alfalfa was destroyed in Nevada by these pests. At about the same time a species of rat, little known except to naturalists, overran the Salt River Valley of Arizona, and before it could be controlled did great damage to forage, garden crops, and fruit orchards.

DAMAGE TO CROPS BY CRAWFISH.

While birds and mammals often play the rôle of pests, it will surprise most people to learn that a species of crawfish, or crayfish, as it is sometimes called, does extensive damage to crops in certain restricted localities in the South. (Pl. XXII, fig. 1.) Heretofore, except for occasional injury, as the result of burrowing into earthen dams, dikes, or fills, crawfish were generally supposed to be of little economic importance. Moreover, in certain localities the larger kinds, especially those inhabiting streams, are somewhat extensively used as an article of food.

Very different is it in the Houston clay lands of Mississippi and Alabama, where in certain areas infested by crawfish it is almost impossible to raise any crops with profit. The formation they inhabit is a heavy gumbo soil from 4 to 15 feet in depth, well saturated with water, and overlying a sandstone formation. This is an ideal home for a species of aquatic tendencies, since in the driest seasons several feet of water remain in the tunnels, and during average seasons the water level is not over 3 or 4 feet below the surface.

The planters within the region of infestation have suffered heavily for years, but it is only recently that the outside world has learned of the extensive depredations caused by this crustacean. Over a wide stretch of country, estimated at not less than 1,000 square miles, crawfish prevent to a very considerable extent the successful production of cotton and corn. They do the greatest amount of damage just after the plant appears and before secondary leaves are developed. (Pl. XXII, fig. 2.) Large fields of young cotton have been destroyed in a single night. Corn also is extensively eaten, but it not so badly damaged as cotton.

An examination of the cotton field, following a raid by crawfish, shows that they tear away the tender cotyledons and carry them to their burrows. It is not known how many plants one crawfish will destroy in a night, but at least a dozen entire leaves have been found at the entrance of a burrow, while probably an even greater number had been carried below. It would seem that the principal feeding is done underground and not during the time of gathering.

Some idea of the number of crawfish in the district may be gained from the statement that in badly infested areas there are from 8,000 to 12,000 holes to the acre. On one plantation near Muldon, Miss., 27 barrels of crawfish were picked up in a season, and the following year 13 barrels more were secured. Another planter in the neighborhood estimates that 200 barrelfuls have been picked up on his plantation in 10 or 12 years. For this enormous quantity he paid a barrel of flour or cornmeal for each barrel of crawfish.

Some cotton planters replant after the first crop is destroyed, and occasionally they thus succeed in securing a fair stand, especially in dry weather. (Pl. XXII, fig. 3.) The crawfish are much more active during showery weather than at other times. If, therefore, frequent rains occur soon after replanting, the chances for a crop are very poor, but in dry weather the plants may develop rapidly enough to be out of danger when wet weather finally appears.

Although the plants of these later crops are necessarily smaller and more backward, they will produce a fair amount of staple cotton if frost is long enough delayed.

Very little is known in regard to the breeding habits of the injurious species. Dr. A. E. Ortmann, an authority on the general subject, thinks there is only one breeding season and that the eggs are laid and the young hatched in spring. The number of young is variable, but usually increases with the age of the mother, so that females which at first have only from 50 to 100 eggs, may later in life produce 400 eggs or more at a time. The development of the eggs requires about a month, and the young remain with their mother for from one to two weeks before starting an independent life. They grow rapidly during the first summer, molting about once a month, until they attain in fall, or beginning of cold weather, a length of approximately 2 inches. Crawfish are solitary in habits, and two are rarely found in one burrow, except during the mating season or when females are accompanied by young.

REPRESSIVE MEASURES.

On account of the large area affected and the great cost of labor and material, deep tile draining seldom has been used as a remedy against the depredations of crawfish. Theoretically, and from a few scattered experiments in other regions, it is thought that by lowering the water level partial or complete relief may be had.

As before stated, immense numbers of crawfish have been collected during rainy weather or in the evening when they leave holes and come to the surface. There is no question that if they are systematically destroyed at every opportunity they will soon cease to be a troublesome pest. Instead of attempting to catch them alive and placing them in receptacles, they can be much more quickly killed by clubs or by crushing under foot. A "shinny stick" makes an admirable weapon, as the terminal bend lies in the proper plane to make an easy and effective blow. Thus laborers can pass from row to row destroying all crawfish in sight. To be effective, the work must be carried on day and night, whenever the crawfish appear on the surface.

An important reason for collecting the crawfish, rather than leaving them to rot where killed, is that when boiled, mixed with meal, and allowed to dry they make an extremely valuable egg-producing food for poultry. Indeed so valuable is this food that if the supply of crawfish were not so dependent upon weather conditions the preparation of this product might prove a profitable commercial undertaking.

No doubt there are many poisons fatal to crawfish, but to insure cheapness our experiments were mainly confined to carbon bisulphide, chloride of lime, and calcium carbide, named in the order of their effectiveness. Chloride of lime has the advantage of being a little less expensive.

CARBON BISULPHIDE.—After many experiments it was found that two or three drops of carbon bisulphide placed in a burrow and the orifice immediately closed by pressure of the foot, kill the crawfish in the course of a few hours. The fluid can be readily inserted in the hole by using a long-nozzle oil can (commonly used by locomotive engineers) with an aperture small enough to allow the proper amount of fluid to escape by simple depression. After a little practice a man can pass rapidly along the rows discharging a few drops of carbon bisulphide in each burrow and closing the orifice with his foot as he proceeds, thus covering a considerable area each day. The cost of the carbon bisulphide is at the rate of 1 cent to 75 holes, or from $1 to $1.50 per acre.

Chloride of lime.—An ounce of a solution of chloride of lime (of the strength of 1 pound to 3 gallons of water) was found sufficient to kill the crawfish in their holes. A 10-quart sprinkling pot, fitted with an oil-can nozzle, is convenient for distributing this solution. Although the cost of enough chloride of lime to treat a certain area is only about a third of that of carbon bisulphide, the time required to make the solution and haul it to the field practically offsets its cheapness. Taking everything into consideration, therefore, chloride of lime has little or no advantage over carbon bisulphide.

Calcium carbide.—Although calcium carbide is effective, its present cost prohibits its use in large quantities. In small fields or where few holes remain on the treated area it is useful on account of the ease of application. It can be used only in burrows that are nearly perpendicular, as otherwise it will not reach the water which is necessary for the development of the fatal gas.

Labor cost.—On account of the innumerable inhabited holes and the care required in their treatment, the cost of labor, when extra help is necessary, is far in excess of that for material. Inasmuch, however, as the soil of the region infested by crawfish can not be satisfactorily worked during wet weather, the workers, who are generally hired by the year, may profitably be employed in killing crawfish in stormy weather. Thus the charge against labor would be only nominal.

In conclusion it may be stated that the most practicable and economical means of coping with the crawfish problem is to combine poisoning with killing the crustaceans by mechanical means. During rainy weather and at twilight in the spring after crawfish become active, the area to be planted with cotton or corn should be visited frequently, and as many as possible of the crawfish killed before seeding time. After the majority have been secured the remaining occupied burrows should be treated with poison, preferably carbon bisulphide.

ROTATIONS IN THE CORN BELT.

By C. B. Smith,
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"It is not so tiring, sir, to plow well,
For your mind is interested."—*English Plowman.*

INTRODUCTION.

For the purposes of this paper the corn belt will be considered as including the States of Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, and Nebraska, together with the southern portions of Michigan, Wisconsin, and Minnesota, the southeastern portion of South Dakota, and the western half of Kentucky.

Within this area is produced two-thirds of all the corn grown in the United States, or about 2,000,000,000 bushels annually. Statistics of this department for the past 10 years show that on the average corn in this area yields about 31 bushels, wheat 15 bushels, oats 28 bushels, and hay 1.4 tons per acre.

These yields are only about half what they ought to be. There are many farmers within the corn-belt area on land no better naturally than the average who, year after year, are getting 50 to 60 bushels of corn, 25 to 30 bushels of wheat, 40 to 50 bushels of oats, and 2 to 2½ tons of hay per acre, with but little increase in the cost of production and with very satisfactory profits. These larger yields are the results of better methods of farming.

COST AND PROFIT IN CORN GROWING.

Since corn is the chief grain grown in the corn belt, it is presumed that farmers consider it the most profitable crop they can raise, and this is undoubtedly true where the yields are large. Data secured by the section of farm economics of this department show that it costs about $14.63 per acre to grow a 60-bushel corn crop on land worth $100 an acre. With cheaper land and lower yields the cost would be decreased.

The 10-year average yield of the corn-belt States is 30.9 bushels per acre, having an average farm value of 42.4 cents per bushel, or $13.11 per acre. It is probably safe to say that with the farm price of corn at 42.4 cents per bushel, the average for the past 10 years, and with a yield of 30 bushels per acre, there is little, if any, profit in growing corn anywhere in the corn belt. The individual farmer does not have it within his power to influence the price of corn for the general market, but he can increase his yields by better methods of farming.

How much corn must be grown per acre to make it profitable? At the average farm price of 42.4 cents per bushel the profits per acre for increasing yields (assuming the cost per acre to be fixed at $14.63) may be seen by examining the accompanying table.

Profit in corn growing with increasing yields.

Yield in bushels per acre.	Value per bushel.	Value per acre.	Cost per acre.	Profit(+) or loss(−) per acre.
	Cents.			
31....	42.4	$13.14	$14.63	−$1.49
35....	42.4	14.84	14.63	+ .21
40....	42.4	16.96	14.63	+ 2.33
50....	42.4	21.20	14.63	+ 6.57
60....	42.4	25.44	14.63	+10.81
75....	42.4	31.80	14.63	+17.17

From the foregoing table it may be seen that with a cost of $14.63 per acre and the price of corn at 42.4 cents per bushel, a yield of 35 bushels per acre returns a net profit of but 21 cents, while the net profit from a yield of 40 bushels per acre is $2.33, and for 75 bushels per acre, $17.17.

The significance and far-reaching importance of these figures from the standpoint of a rotation of crops may perhaps be understood more fully if they are presented in a slightly different manner. Thus, based on the profits per acre as shown in the last column of the table, it may be seen that there is as much net profit in one 40-acre field of corn yielding 40 bushels per acre as there is in a 443-acre field of corn yielding but 35 bushels per acre; while a 40-acre field of corn yielding 75 bushels per acre returns as great a net profit as a 293-acre field yielding 40 bushels per acre, a 104½-acre field yielding 50 bushels per acre, or a 3,270-acre field yielding but 35 bushels per acre.

These data bring out in a striking way the importance and necessity of so handling the farm as to get increased yields above the average of 31 bushels per acre.

How can an increased yield be obtained? Data secured by the experiment stations and by this department on many farms throughout the corn belt show that it is as easy to grow 45 to 60 bushels of corn per acre after a clover or alfalfa crop as it is to secure 30 to 35 bushels after a corn or an oat crop. The agricultural experiment station of Nebraska records[1] that in one investigation 31 farmers reported average yields of $34\frac{1}{2}$ bushels of corn per acre on land before seeding it to clover and alfalfa and 68.2 bushels per acre on the same land after it was plowed up and again planted to corn.

CONTINUOUS CORN CULTURE.

When the rich, black, prairie corn lands of the Central West were first broken up it was believed that these were naturally inexhaustible lands and would never wear out. So crop after crop of corn was planted on the same fields. There came a time, however, after 15 or 20 years, when the crop did not respond to cultivation; the yields fell off, and lands that once produced 60 to 70 bushels per acre annually dropped to 25 or 30 bushels. Insects had greatly injured the crops; the land was "corn sick." In times of drought the corn easily fired.

Bad practices had developed. The stalks, having little or no commercial value, were left standing over winter for pasture and were then broken down, raked into windrows, and burned. At first the loss of this vegetable matter by burning was not noticeable, but with the passing years the soil became more compact and less friable, droughts were more injurious, and the soil baked harder and was more difficult to handle.

This practice of stalk burning is still too prevalent in many sections of the corn belt. It is a vicious practice and should be abandoned. No farmer is so rich that he can afford to burn his cornstalks and thus rob the soil of this supply of vegetable matter, which is the very first essential and foundation of good farming anywhere.

Continuous corn culture has no place in progressive farming. As a temporary practice on rich virgin soils it is legitimate perhaps for a few years while the farm is being paid for and some of the comforts are being accumulated about the home, but it is a shortsighted policy for any other purpose and is suicidal on lands which have been long under cultivation.

CORN IN ROTATION WITH OATS.

With decreasing and unprofitable yields resulting from continuous corn culture came the oat crop as an alternating and improving crop. For a time corn grown after oats gives increased yields, not very large to be sure, but still better than corn in continuous culture, and some of the older farmers in the corn belt have not yet passed beyond this stage of farming. Oats add no plant food to the soil and are quite generally an unprofitable crop. The fact that oats can be seeded in the spring and the comparative ease with which the ground

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[1] Bulletin 122, Nebraska Agricultural Experiment Station.

can be put in shape for them are the chief reasons for their use. Like continuous corn culture, a rotation of corn and oats may be justifiable as a temporary makeshift, but it has no place as such in a system of permanently productive agriculture.

THREE-YEAR ROTATION: CORN, OATS, AND CLOVER.

On all the land throughout the corn belt there comes a time when the yields from continuous corn culture, or of corn in rotation with oats, fail to give satisfactory returns. Good farmers then seed clover with the oats and leave the land down in clover the year following the oat crop. The clover sod is then plowed under and the land planted to corn, thus making a three-year rotation—corn one year, oats one year, and clover one year.

The addition of clover to the rotation is a great step forward in progressive and constructive agriculture. Its use not only adds one year to the rotation, thus resting the land from corn that much longer, but it actually enriches the soil by adding nitrogen, a valuable plant food, and, what is probably fully as important, it makes available large amounts of phosphorus and potash in the soil by the decay of its roots and other residue. In the decay of this organic matter both the soil and subsoil are also improved physically. In field tests extending over 29 years on the black corn lands of central Illinois, the experiment station of that State[1] found that at the end of that time corn grown continuously on the same land yielded 27 bushels per acre as an average for the last three years of the test. Corn grown in rotation with oats yielded 46 bushels per acre, while corn grown in rotation with oats and clover yielded 58 bushels per acre without the aid of either fertilizer or manure. These results are typical.

The growing of hay paves the way for a live-stock system of farming and a more equitable distribution of labor throughout the year. The objection to a three-year rotation like this is the fact that only one-third of the farm is in corn each year. As previously shown, however, there is likely to follow as great a net profit from this one-third of the farm in corn, with its larger yields, after clover and with the aid of farm manures made on the place, as there would be on the whole farm put into corn without clover in the rotation.

In some of the newer sections of the corn belt, where the land is still rich in humus and nitrogen, some grain farmers sow clover seed with oats in the spring and then plow down the clover that same fall, thus making a two-year rotation of corn and oats, with clover as a catch crop; or two crops of corn and one crop of oats are grown. As long as a good crop of clover can be secured this system gives good results.

[1] Bulletin 125, Illinois Agricultural Experiment Station.

FOUR-YEAR ROTATION: CORN, CORN, OATS, AND CLOVER.

In a three-year rotation but one-third of the land is in corn. Since corn is the chief money crop, every farmer desires to grow as much corn as possible, consistent with good farm practice. Instead, therefore, of growing but one corn crop after the clover crop, two crops are grown and the rotation becomes corn, corn, oats, and clover. This is a good rotation on good land and about 10 per cent more profitable than the three-year rotation previously described. It is successfully carried out on practically all the ordinary prairie soils of the corn belt, where there still is, for the most part, a large stock of nitrogen and humus in the soil. To be successful over a period of years this rotation requires that the cornstalks be left on the ground, either as manure or cut up, and that the oats, clover, and possibly a part of the corn be fed on the place and the manure returned to the land. It should not be practiced on poor or run-down lands.

CORN IN ROTATION WITH CLOVER ONLY.

The fact that oats frequently fail to return a profit has led a few farmers to omit them and run a rotation of corn and clover only. Usually two corn crops follow one clover crop. This gives two-thirds of the farm in corn each year. The objection to this plan is the frequent failure to get a catch from seeding clover in the standing corn at the last cultivation. When the ground is clean of weeds and firm, but the topsoil loose and sufficient moisture present, a satisfactory stand can generally be secured, but these conditions do not prevail every year.

In case the clover thus seeded fails, the field can be disked and reseeded to clover alone the following spring. Seeding clover in this manner is one of the surest ways to get a stand on land comparatively free from weeds, but on weedy land it is no more likely to succeed than if it were sown with oats.

This rotation of corn and clover is most likely to succeed on rich, black, corn lands, where a catch of clover in standing corn is much more certain than on the average upland clay soil. This method of corn farming is successful only in the hands of the more careful and resourceful farmers and is not to be recommended as a general practice.

CORN IN ROTATION WITH WHEAT; CLOVER AS A CATCH CROP.

Corn in rotation with wheat alone is no more profitable and as certainly leads to decreased yields of both crops as does a rotation of corn and oats, but on some of the richer soils in certain sections of the corn belt where winter wheat thrives a two-year rotation of corn and wheat, with clover as a catch crop in the wheat, has developed, which gives very satisfactory results. The wheat is seeded in the fall and clover the following spring. After the wheat is cut the clover comes on and makes a considerable late summer and fall growth, which is plowed down for corn.

In this rotation the clover is not cut for hay, the entire growth being turned under for green manure. In this system half the farm is in corn and half in wheat each year, and, as long as a good crop of clover can be secured to turn under, it is one of the most profitable rotations for a grain farm where wheat does well. Should the clover fail to catch in the wheat it is still possible in the more southern portions of the corn belt to sow a crop of cowpeas after the wheat is harvested, to be turned under for corn the following spring.

By letting the clover stand one year, and cutting for hay or seed, this two-year rotation becomes a three-year rotation, corn, wheat, and clover. By seeding timothy in the fall and clover in the spring and letting the grass stand an extra year for hay or pasture it becomes a four-year rotation. A two-year rotation of corn and wheat, with clover as a catch crop, or a three-year rotation of corn, wheat, and clover, or a four-year rotation of corn, wheat, wheat, and clover, is often adopted in sections where oats are unprofitable and the farmer desires to omit them from the rotation.

In the four-year rotation of corn, wheat, wheat, and clover the clover may be seeded with the first crop of wheat, but since the corn land is prepared by disking for the crop the ground is likely to be rough, and farmers prefer to seed with the second crop on the smoother plowed soil. This is a popular rotation on soils specially well adapted to wheat growing.

CORN IN ROTATION WITH OATS, WHEAT, AND CLOVER.

On lands in the corn belt not so well adapted to corn as the black prairie soils the small grains play a more important rôle in the operations of the farm. One of the most popular rotations in such sections and the most satisfactory from the standpoint of labor distribution is (1) corn, (2) oats, (3) wheat, and (4) clover and timothy one or two years. This rotation is adapted to either grain or stock farming, and where pasture is needed the clover and timothy may be left down two years, cutting it for hay the first year and pasturing it the second year, thus making it a five-year rotation.

The principal products sold from the farm in this rotation are wheat, live stock, and live-stock products. As long as good clover crops are secured and the manure of the farm is properly handled and returned to the land, this system will permanently maintain the humus and nitrogen content of the soil, particularly if leguminous catch crops, such as cowpeas or vetch, are sown in the standing corn at the last cultivation.

In general farm practice with this rotation and with most of the rotations noted in the preceding pages in which clover is used, timothy is nearly always sown, being seeded in the fall in the case of wheat or rye and mixed and seeded with the clover in the case of spring-sown grains. Too often, indeed, timothy constitutes the greater part of the mixture and frequently it is made to replace the clover altogether. It must be remembered, however, that the timothy adds no plant food to the soil, nor does it build up the land.

The weakest place in this rotation in many sections of the corn belt is the oat crop. In many cases where farmers started this rotation when oats were a profitable crop, they do not know just how to get out of it now that the oats have become unprofitable. To meet this difficulty the rotation described below has been adopted by many farmers.

CORN IN ROTATION WITH COWPEAS OR SOY BEANS, WHEAT, AND CLOVER.

In the southern half of the corn belt, farmers generally consider oats an unprofitable crop and grow them only because they fit so well into the rotation as a crop to follow corn. Another reason sometimes assigned for growing oats in the corn belt, even where unprofitable, is in order to have the straw to use as bedding. Sometimes oats are also grown under the belief that they are essential as a nurse crop for clover. As a matter of fact none of these reasons for growing oats is valid unless each year the crop can show a profit in itself.

In southern Indiana, southern Illinois, portions of Ohio, and much of Missouri and Kansas either cowpeas or soy beans may profitably be substituted for oats in the rotation. Both these crops may be grown either for grain or hay, producing a quality of product even superior to oats for feeding purposes. Both are legumes, and therefore are superior to oats as crops for improving the land, and both possess the still further advantage of making it unnecessary to plow the ground after them, as in the case of oats, for wheat. Disking is preferable and can be effectually done when dry weather would make plowing impossible. Furthermore, both cowpeas and soy beans can be grown successfully on poorer land and on land in a poorer condition of tilth than can oats, and in themselves, either for feed or hay, they will return a greater cash value than oats.

As to which is the more profitable, cowpeas or soy beans, that matter has not been satisfactorily determined and will vary with the locality.[1] The soy beans will stand a little more frost and therefore can be safely grown a little farther north than cowpeas.

[1] See Farmers' Bulletins 318, Cowpeas, and 372, Soy Beans, U. S. Dept. of Agriculture.

Recent field observations have led to the belief that soy beans will have by far the broader general application and will thrive under a greater variety of soil conditions than cowpeas. On the heavier lands along the central and north-central sections of Ohio, Indiana, and Illinois soy beans are being grown with greater success and with greater profit than cowpeas. Throughout these sections and on the heavier corn lands cowpeas failed to give satisfactory results, but where soy beans are properly grown, which includes a proper inoculation of the soil at planting time, this crop may be very successful. Without inoculation, soy beans are being grown with marked success on some of the stronger soils. However, judging from the past experiences of farmers over large areas, it is safer to use inoculation as a precaution against failure even on the best land.

The value of the soy-bean crop in the sections mentioned is being realized more and more each year and it is rapidly filling a very important place in the rotation on the average farm. At present the crop is principally used to supply feed for live stock, but with the prevailing prices of seed, farmers will doubtless gradually go into seed production, allowing the crop to fill the same place in the rotation as at present.

With a four or five year rotation of (1) corn, (2) cowpeas or soy beans, (3) wheat, and (4) clover and timothy one year or more, the land will be plowed but once in the rotation and that for the corn crop. For the cowpeas or soy beans and for the wheat, disking the ground will usually be sufficient.

In sections where wheat is a more than usually important crop it is often desirable to grow more than one crop in the rotation. For this purpose the above rotation is sometimes modified as follows: (1) Corn; (2) cowpeas or soy beans; (3) wheat, with cowpeas sown as a catch crop immediately after the wheat is harvested and grown either for hay or disked for wheat; (4) wheat; and (5) clover and timothy. Or wheat may follow corn immediately, with a catch crop of cowpeas seeded on the wheat ground as soon as harvested. In this case the rotation will be (1) corn, (2) wheat plus cowpeas, (3) wheat, and (4) clover and timothy. Where clover does not grow satisfactorily the rotation might be (1) corn, (2) wheat with cowpeas as a catch crop, and (3) wheat with cowpeas as a catch crop, then back to corn again.

CORN IN ROTATION WITH ALFALFA.

Where alfalfa can be successfully grown, a combination of corn and alfalfa makes about as satisfactory and profitable a rotation in the corn belt from the standpoint of maintaining productiveness and financial profit as it is possible to devise. After alfalfa, corn gives from 30 to 50 per cent larger yields than after clover. With clover about one-third of the nitrogen in the plant is in the roots and two-thirds in the portion above ground, which is removed when the crop is cut for hay; while with alfalfa about two-thirds of the nitrogen in the plant is in the roots and only one-third in the portion above ground. Owing to the fact that it usually takes a full year to get alfalfa started and that it is not desirable to plow up the fields so long as good yields are being obtained, the land is left much longer in alfalfa than in the case of clover, and more corn crops are grown before returning to alfalfa. A typical rotation is the following: (1) Corn, (2) corn, (3) corn manured, (4) small grain seeded with alfalfa, and (5) alfalfa three to six years. On land where it is difficult to secure a stand of alfalfa with a nurse crop of small grain, the small grain is omitted.[1]

In these two crops, corn and alfalfa, is realized more nearly than in any other combination of crops yet grown in the corn belt the maximum of grain and hay yields and of profits that can be secured from an acre of land by ordinary methods of farming. Wherever a farmer can substitute alfalfa for clover and timothy in the rotation without too great a cost, he will be able practically to double his profit.

CORN IN ROTATION WITH RYE.

Rye is a very minor crop in the corn belt, constituting less than 1 per cent of the total grain grown. Nevertheless it has an important place in some sections, particularly on the sandy and poorer soils, where it will often give a fair yield when wheat, oats, or barley will return little. It is also regarded as a better crop to seed clover with than any other of the grains, as it is less leafy and is sooner harvested, thus giving better opportunity for the clover to grow. One of the most popular rotations is (1) corn, (2) rye, and (3) clover, each one year. Rye, like wheat, is seeded either in the standing corn or after the corn is removed in the fall, and the clover is sown the following spring. Rye, of course, like all grains, responds to better soils and on the richer lands of the corn belt is often used as a substitute for oats in a rotation of corn, corn, rye, and clover.

CORN IN ROTATION WITH BARLEY.

Only in one State in the corn belt does barley amount to as much as 1 per cent of the grain grown. In Iowa, however, nearly 4 per cent of the total grain crop is barley. Barley requires as good land for its successful culture as oats. It occupies exactly the same place in the rotation as oats, except in the case of winter barley, but is

[1] For methods of growing alfalfa see Farmers' Bulletin 339, U. S. Dept. of Agriculture; also Bulletin 155, Kansas Agricultural Experiment Station.

regarded as superior to oats as a nurse crop for clover. In Iowa the last 10-year average shows a little larger cash return per acre for barley than for oats. Rotations of (1) corn, (2) barley, and (3) clover, or (1) corn and (2) barley, with clover seeded in the barley and plowed down the same fall for corn, and all the other combinations mentioned in the preceding pages with oats, may be successfully practiced with barley.

MISCELLANEOUS ROTATIONS.

With the preceding crops the number of possible rotations is limitless; only the most practical of these which may affect most farmers have been touched upon. Local rotations where corn does not form a part have been entirely omitted. A 6-year rotation of (1) corn, (2) corn, (3) oats, (4) corn, (5) oats, and (6) clover has been found on a grain farm where but little hay was required. Farther south a rotation of (1) corn, (2) corn, (3) cowpeas, (4) corn, (5) clover, and (6) clover has been used on a hog farm, and while meeting the needs of the hogs, bunched the labor too much in the spring. On some large cattle farms a rotation of corn four or five years with hay and pasture four or five years is successfully practiced.

PRINCIPLES GOVERNING THE ESTABLISHMENT OF ROTATIONS.

Farmers adopt rotations because they desire (1) to get larger yields and profits per acre; (2) to distribute their work more equitably throughout the season; (3) to be more certain of an annual income than is possible where a single crop is grown; (4) to maintain the productiveness of the farm; and (5) to minimize the injury from weeds, insect pests, and diseases that generally accompany a system of one-crop farming. A systematic rotation whereby different crops follow one another from year to year on each field of the farm in orderly succession makes possible a more careful planning of the year's work.

In planning a rotation it is necessary to keep in mind the income it will bring, the needs of the land, the requirements of the stock kept on the place, the effects of each crop on the yields of the succeeding crops, and the profitable distribution of labor. There are three main classes of crops to deal with in planning a rotation: (1) Small grain crops, (2) hay crops, and (3) cultivated crops. Long experience has taught that as a general proposition permanently productive and profitable farming requires that these three classes of crops be systematically rotated with each other. This proposition holds true for the corn belt.

In the rotations discussed, corn is the cultivated and cleaning crop of the rotation, but the area of corn land that can be cultivated efficiently with the usual farm force is limited. This makes desirable the planting of some other crop, such as wheat or oats, which can be put in before corn is planted and requires no cultivation. When the corn is laid by, the harvesting of the grain can begin.

Both the corn and the small grain reduce the productiveness of the land; therefore to offset this a soil-enriching crop, such as clover, cowpeas, vetch, soy beans, or alfalfa, should be grown.

LEGUMES IN THE ROTATION.

Every successful rotation revolves around some legume as a chief soil enricher and conditioner. So far as known, history does not record a single instance of any long-continued successful system of general farming that has not included one or more legume crops. The legume is the key to every rotation. The principal legume in the greater part of the corn belt is red clover. In Kansas and Nebraska it is alfalfa. When clover winterkills, in order to meet the immediate situation in the southern half of the corn belt, the field should be disked or plowed and planted to cowpeas or soy beans. If too far north for these, a mixture of Canada field peas and oats for hay or grain in the proportion of 1 bushel of peas to 1 of oats may be planted. If red clover seeded in the spring fails to show a stand at harvest time, the stubble should be thoroughly disked, reseeding to clover and harrowing it in. This should be done by the middle of August or before the first of September if possible. The chances are that the clover will make a fair growth that fall and live through the winter. The importance and methods of securing stands of clover in the corn-belt rotations are forcibly brought out by J. A. Drake[1] in his circular on this subject. On all of the poorer corn lands cowpeas and soy beans should be used at the last cultivation of the corn crop as a green manure and for pasture where stock are kept. In the more northern sections. especially on sandy lands, hairy vetch should be sown.

The use of alfalfa on the richer and better drained lands of the corn belt is highly desirable, and to that end it is suggested that from 2 to 3 pounds of seed per acre be mixed each year with the clover and timothy sown until all of the fields of the farm become inoculated and this legume forms a large part, if not all, of the hay grown. It not only increases the hay yield, but corn also yields more after alfalfa than after clover.

FERTILIZERS IN CORN-BELT ROTATIONS.

A rotation of crops, even where clover is grown, is not sufficient in itself to maintain the productiveness of the soil. After a while the

[1] The Management of Clover in Corn-Belt Rotations. Circular 111, Ohio Agricultural Experiment Station.

clover fails; then the whole system of farming fails. Clover is beginning to fail on many of the corn-belt farms. So long as crop yields are satisfactory the matter of commercial fertilizers may be neglected. A good rotation with the judicious utilization of all the farm manure is the first essential. When the yields in such a system begin to fail, then commercial fertilizers may be considered. Rightly used as a supplement to a good rotation and to farm manures, commercial fertilizers are profitable and their intelligent use advisable. Used without a thorough understanding of their nature and the part they play in the growth of a crop, loss is as likely to result as profit. Practically all the agricultural experiment stations in the corn-belt States have issued bulletins dealing with the use of fertilizers for different crops, for which the reader should send.

SUMMARY.

(1) Average corn yields return little or no profit.

(2) Continuous corn culture, or corn in rotation with oats, barley, timothy, wheat, or other exhausting crops, is justifiable only as a temporary expedient, like getting out of debt. Such a cropping system leads rapidly to decreased yields and a run-down farm.

(3) The addition of clover, alfalfa, or other legume, to the rotation is a long step forward in progressive, profitable, and permanent agriculture. It is the first step necessary in building up the farm and in maintaining increased yields.

(4) A rotation of crops alone, even when clover is included, will not maintain yields permanently. After a while the clover fails. With it the whole system fails.

(5) Barnyard manure is one of the best fertilizers to use in keeping up yields permanently. In addition, some soils require that lime and phosphorus, or potash, or all three, be added to secure the highest thrift of the clover crop and the greatest yields of corn.

(6) Legumes, live stock, and fertilizers, stated in the present order of importance in the corn belt, are the essential features which enter into a system of farming that will keep the soil permanently productive and return maximum yields.

THE WINDS OF THE UNITED STATES AND THEIR ECONOMIC USES.

By P. C. Day,
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SOURCE OF DATA.

At each of the principal telegraphic reporting stations of the Weather Bureau in the United States there is maintained, by use of the most approved apparatus, a continuous record of the velocity and direction of the wind. These records at many of the stations extend back to the establishment of the Government weather-reporting service in 1871, thus furnishing continuous records of wind velocity for the past 40 years.

The total number of stations at which a continuous record of wind movement is now maintained by the Weather Bureau is about 200, which, with others that have been in operation during portions of the above period, but discontinued for various reasons, makes it possible to obtain fairly good records of the hourly, daily, monthly, or annual values of the wind movement at about 300 different points well distributed over the United States, and embracing every character of exposure from near the level of the sea to the tops of some of the highest mountains.

Probably in no other country of the world has there been accumulated such a wealth of data from which to deduce important information as to the character of the winds, their peculiar distribution, and their variations over such a large area as is now available from the records of the U. S. Weather Bureau.

Despite the fact that many of the data so collected have been printed both monthly and yearly in the various Weather Bureau publications, no extensive compilation of these individual values into harmonious totals, averages, etc., has been published in convenient form for ready reference by those interested in the study of the winds, either in scientific investigations or in the practical application of their energy to usefully serve our every-day needs.

DISCUSSION OF AVAILABLE DATA.

In any discussion of the winds, their force, or direction, it is of first importance that the elevation of the registering instrument above the ground during the period of observation be known, as also the details of the local environments.

On account of the commercial demands for prompt information regarding weather conditions, it is generally necessary to locate Weather Bureau offices, including the instrumental equipment, at points in close contact with the great business centers, often in the very heart of the larger cities, where the erection of new and taller buildings in the immediate vicinity, which interfere with the proper exposure, requires frequent changes in the elevation of the instruments.

As a result of these changes in elevation and environment, the compilation of average values of the wind movement or direction is attended with much difficulty when attempt is made to reduce the observed data to some standard elevation and exposure for all stations.

The accompanying charts (Pls. XXIII to XXIX), showing the average hourly velocities of the wind and its direction throughout the various portions of the country and for special months of the year and hours of the day, with diagrams indicating the daily march of the winds and their variations at different levels, present a graphic summary of some of the more important features of a paper on the winds of the United States which the writer is now preparing for publication as one of the series of bulletins issued by the Weather Bureau.

The limits of this article will not admit of the publication of detailed tables or of any extended discussion of the local features that a close study of the individual tables may disclose, and only a few of the more important details will therefore be touched upon in this brief review.

The data from which the charts were prepared are based mainly upon records for the 20-year period, 1891 to 1910, inclusive, that period of time being considered sufficient to establish a satisfactory average, and are therefore comparable as to the period of time covered, and they are also presented in the local standard of time in use at the several stations.

As the variations in elevation at the different stations are such that a chart showing the average velocities without regard to the elevation of the instruments above ground would be without value, an attempt has been made to correct the recorded velocities at each station to the velocity it is estimated the wind would have attained at a uniform elevation of about 100 feet above the earth's surface.

CHANGES IN VELOCITY DUE TO ELEVATION.

Observations of the wind velocity at various elevations above the ground show that near the earth's surface the velocity increases rapidly with increasing elevation. In the vicinity of the Salton Sea, Cal., observations of the wind velocity for various elevations made in connection with certain evaporation investigations showed that from the earth's surface to an elevation of 10 feet the increase in the average hourly velocity was at the rate of about 17 miles per 100 feet, from 10 to 20 feet the increase was at the rate of about 10 miles per 100 feet, and from 20 to 40 feet the rate of increase diminished to about 7 miles per 100 feet, while from observations made at the top of the Eiffel Tower, at Paris, the rate of increase from an elevation of about 70 feet above the earth's surface to the top of the tower, 1,000 feet, averaged about 1.6 miles per 100 feet.

A comparison of the wind velocities at a number of the stations of the Weather Bureau where changes in elevation have been made, both before and after removal, with the records from near-by stations whose elevations have remained unchanged, together with data from a few stations where at time of removal comparative records were made for short periods at both exposures, indicates that from about 50 feet to 100 feet elevation the hourly rate of increase averages about 3 miles per 100 feet, and from 100 to 200 feet the average increase in velocity has been estimated as at the rate of 2 miles per 100 feet. It is probably true that near large bodies of water and over the level prairies the rate of increase in wind velocity at the lower elevations is much less than for corresponding changes over the broken, hilly, and wooded parts of the country, but at the present time it is not feasible to attempt to differentiate between these exposures. In preparing the accompanying charts the records of wind velocity at the various stations in the United States have therefore been corrected to a common elevation of 100 feet above the ground by applying a positive correction to the observed average hourly velocity at the rate of 3 miles per 100 feet at all stations where the wind instruments are exposed at from 50 to 100 feet elevation, and a negative correction at the rate of 2 miles per 100 feet at stations with elevations greater than 100 feet. At but few of the stations is the elevation less than 50 feet, and likewise but a small number have elevations exceeding 200 feet.

In view of the fact that in the large cities the expanse of buildings acts in the same manner as the earth's surface in retarding the progress of the winds, thereby raising the general surface to the average level of the roofs of the buildings, it is deemed necessary to make some allowance for that condition. Therefore, in the largest cities, 500,000 population or over, it is estimated this factor is equivalent to 50 feet elevation, and in cities from 100,000 to 500,000 population it is estimated at 25 feet, and a corresponding correction has been applied to the records.

It must be understood, of course, that all these corrections are largely estimates, and a closer study of the question may show that for certain stations or areas the corrections are in error, since it is well known that the wind velocity is greatly influenced by local topography, such as the trend of the mountains and the configuration of the land and water areas, giving rise to currents of widely different velocities at even near-by points, or modifying materially the rate of increase with elevation, and it is recognized that these conditions should be considered as far as practicable in reducing the discordant values to a comparable basis.

HOURLY VELOCITIES.

A glance at Plate XXIII, "Average hourly wind velocities," clearly shows the effects of elevation, of proximity to large bodies of water, and of the open, level plains in the increased wind movement. Along the Atlantic coast the alternating land and sea breezes carry the average velocity for the entire year beyond 10 miles per hour, and for exposed points and for certain months of the year the wind attains average velocities as high as 16 and 18 miles per hour. Similar conditions prevail along the Great Lakes, where, near the shore line, the average velocities rise to 10 and 12 or more miles per hour. Likewise, along the Gulf coast the wind attains considerable average velocity.

On the Pacific coast the sea breezes are usually quite moderate from central California southward, the average velocity at San Diego being less than 6 miles per hour. On the middle and north Pacific coast, however, extremely high winds prevail at times, and at some of the headlands along the immediate coast of central California the average velocity of the wind exceeds that registered at the summit of Pikes Peak, Colo., at an elevation of more than 14,000 feet above sea level.

HIGH WINDS ON THE MIDDLE PACIFIC COAST.

At Point Reyes, Cal., a small peninsula jutting into the Pacific Ocean a short distance north of the Golden Gate, the average annual velocity of the wind at an elevation slightly exceeding 500 feet above sea level and less than 50 feet above the ground reaches 20 miles per hour, and during some months of the year the average velocity is more than 25 miles per hour.

Among some of the remarkable winds that have occurred at that point may be mentioned the storm period of May 15 to 20, inclusive, 1902, during the entire 6 days of which the average wind velocity exceeded 50 miles per hour, and for a period of 24 consecutive hours it blew at the rate of nearly 80 miles per hour, with a maximum velocity for a 5-minute period of 110 miles and an extreme velocity at the rate of 120 miles per hour. Likewise, during May, 1903, the velocity averaged more than 50 miles per hour for 9 consecutive days—May 14 to 22, inclusive.

WINDS OF THE GREAT PLAINS.

Over the Great Plains region from the Dakotas to Texas the average wind velocities approach those near the seashore, ranging from nearly 12 miles per hour in North Dakota to more than 15 miles in the Panhandle of Texas. The wind movement in the above region is highest as a rule in April and lowest during midsummer, the average velocity for April exceeding that for July by from 25 to nearly 50 per cent.

WINDS IN MOUNTAIN REGIONS.

In the protected valleys of the Appalachian Mountain region the winds are usually light, generally less than 8 miles per hour, but at exposed points, especially in the northern portions, the velocities are much higher; indeed, the highest wind velocities in the United States are probably registered at the top of Mount Washington, N. H., elevation about 6,300 feet, where even during the summer months the average hourly velocity exceeds 25 miles, and in winter, under the influence of the cyclonic circulation, due to its location in the path of nearly all the storm tracks that cross the United States, the average velocity rises above 30 miles per hour. These high velocities do not prevail throughout the entire elevated portions of the Appalachian Mountain region, however, but diminish rapidly toward the south. At Mount Weather, Va., elevation slightly more than 1,700 feet, the average velocity in January is 18.3 miles per hour, and in July it is but 11.7 miles; while at Mount Mitchell, N. C., elevation 6,700 feet, about 400 feet higher than Mount Washington, the average velocity during the summer months appears to be but slightly more than 10 miles per hour. Likewise, in the mountain and plateau districts of the West the wind velocities at the less-exposed points are quite low, while at the extreme elevations the velocities are not so high as at Mount Washington, and are but slightly higher than those near the sea level at exposed points on the middle and north Pacific coast. The average velocity for the year on Pikes Peak, Colo., elevation 14,134 feet, is but 22.2 miles per hour, falling to an average of 13.5 miles in July and rising to 27.1 miles in March.

DAILY MARCH OF THE WIND.

The average daily march of the wind near the earth's surface for each hour of the day and each month of the year is shown for two representative stations, one on the eastern seacoast and the other in the middle Plains region. (See figs. 9 and 10.) In both cases the action of the sun's heat in accelerating the wind movement is graphically shown, the wind rising regularly with the increased power of the sun's advancing heat and falling with the lessening effect of its declining rays. Near the earth's surface the average increase in wind movement during the daylight hours, over those of the night time, ranges very generally from 20 to 40 per cent, and in exceptional cases the increase is 50 per cent or more above the average

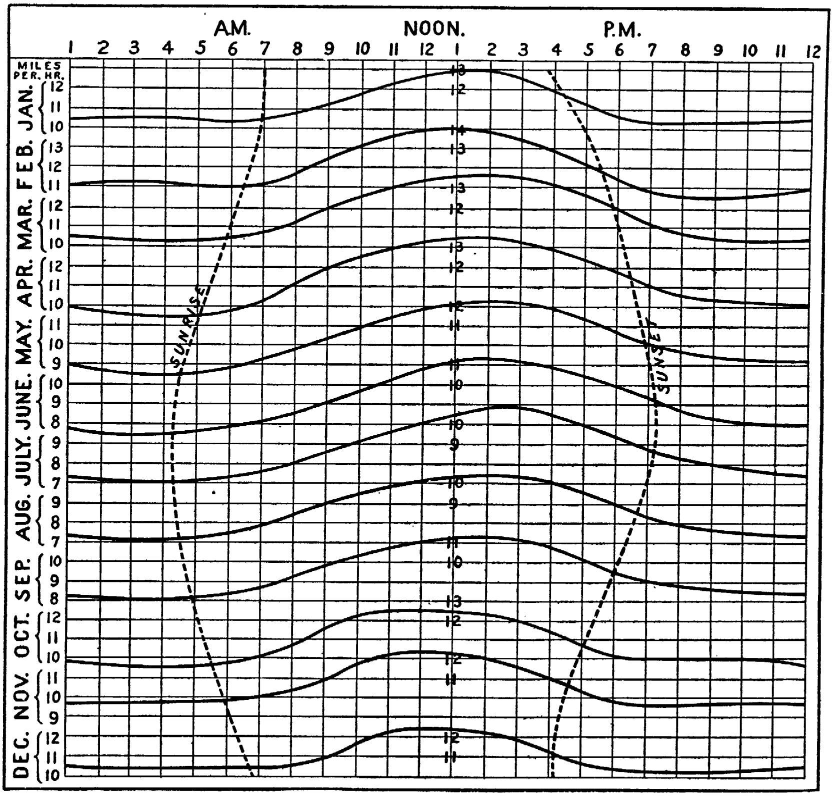


FIG. 9.—Diurnal march of the wind near the earth's surface, seacoast station, Atlantic City, N. J. Local standard time.

night velocity. A few exceptions to this rule occur near the Pacific coast where, on account of small temperature changes or the effect of local air drainage, the night velocities are equal to or slightly greater than those of daylight. For the upper elevations the daily march of the winds is reversed from that near the surface, the elevation at which this reversal takes place varying with local conditions, and the night velocities exceed those of the daylight hours. Figure 11 shows the hourly values for Pikes Peak, Colorado, and similar results are shown in the records from Mount Washington, New

Hampshire; Mount Mitchell, North Carolina; and Mount Tamalpais, California. At Mount Mitchell the velocity at noon is but slightly more than 50 per cent of the midnight velocity, and at Mount Tamalpais similar conditions exist, while at Pikes Peak and Mount Washington the midday winds are from 75 to 85 per cent of their velocity at midnight.

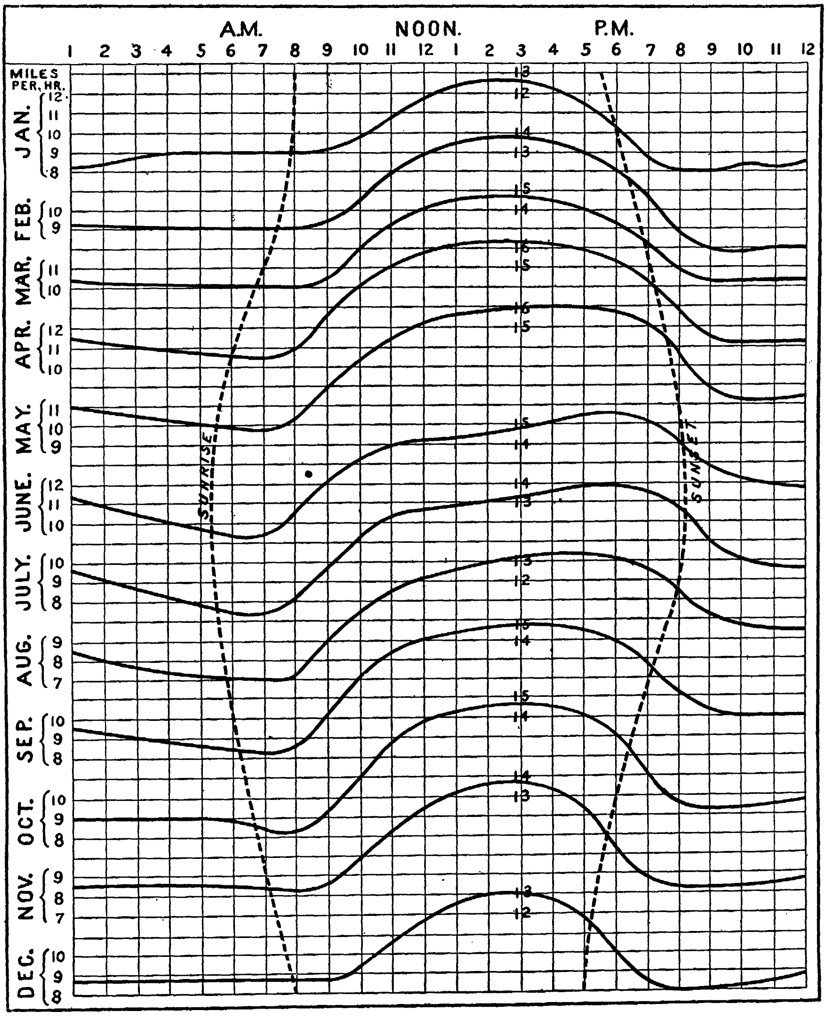


FIG. 10.—Diurnal march of the wind near the earth's surface, inland station, Dodge City, Kans. Local standard time.

WINDS DURING THE DAYLIGHT PERIOD.

Plate XXIV shows the average hourly velocity of the wind during the daylight hours, 6 a. m. to 6 p. m. During this period the average velocity of the wind rises to 10 miles per hour or more over large areas of the country and passes above 14 miles per hour in portions of the Great Plains region and above 15 in the Panhandle of Texas, the western portions of Oklahoma, and in parts of North Dakota. Along the shores of the Great Lakes it is above 10 miles and exceeds 12 miles per hour at exposed points, while at points on the Atlantic and Pacific coasts the average velocity is in excess of 16 miles per hour.

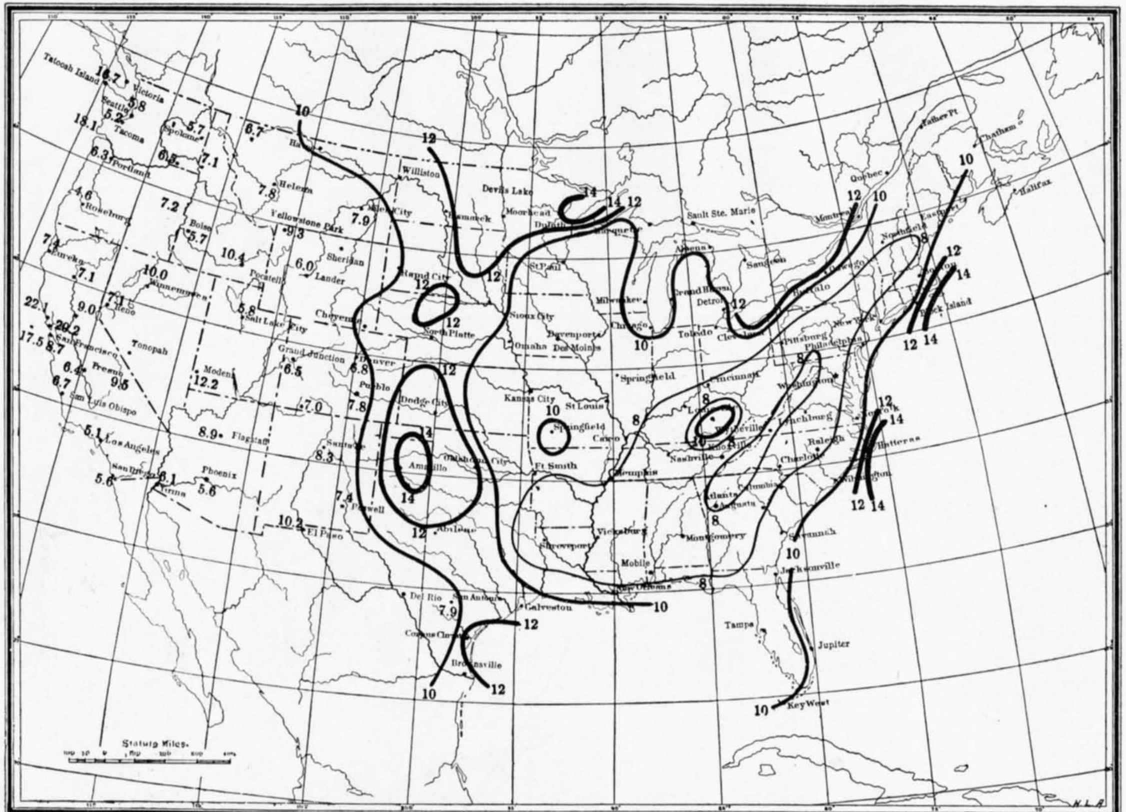
In the protected valleys of the Appalachian Mountain region and in the interior of the Gulf States the average velocity is somewhat less than 10 miles, and similar velocities appear on the south Pacific coast and in the protected valleys of the western mountain and plateau districts.

EXTREME DAY AND NIGHT VELOCITIES.

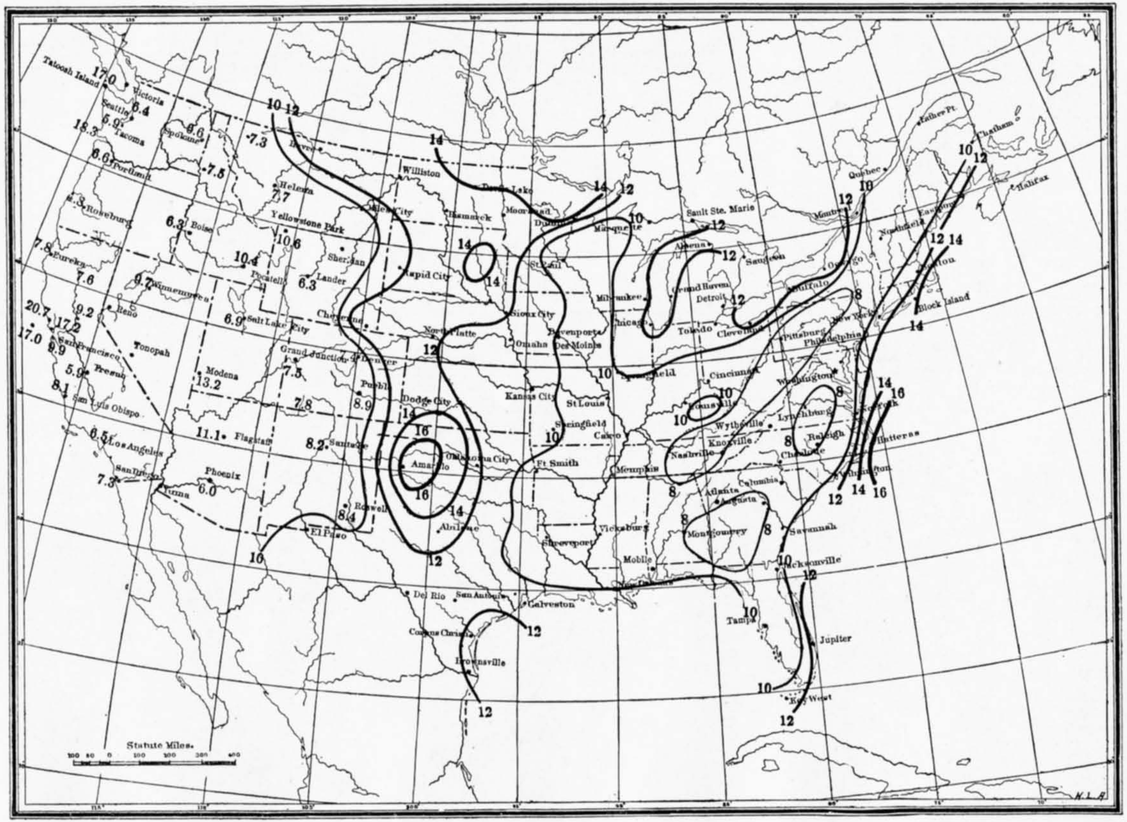
Plates XXV and XXVI show the average velocity at 3 p. m. and at 6 a. m., respectively, local time, these being the approximate hours of maximum and minimum wind movement. The marked difference in the velocities shown on these charts is apparent when the areas above and below an average of 10 miles is considered; in fact the increase of the winds near midday over those near sunrise averages generally more than 50 per cent of the lower velocity, but ranges from more than 100 per cent down, depending upon the location of the station and its environments. Along the immediate Atlantic coast this increase is quite small, ranging from 10 to 20 per cent, and it is likewise low on the lower lakes and to a less extent on the upper lakes and on the Gulf coast. On the Pacific coast it ranges from 151 per cent at San Diego to —3 per cent on the extreme northwest coast of Washington, with marked variations on the middle Pacific coast. At San Francisco, Cal., the average velocity at 3 p. m. exceeds that at 6 a. m. by 146 per cent, while at Point Reyes the 3 p. m. velocity is 5 per cent less than that at 6 a. m. The increased velocity of the early afternoon winds over those of the early morning is most pronounced in the regions of light winds. In the protected valleys of the Appalachian and Rocky Mountain regions this increase ranges from 75 to more than 100 per cent, while over the Great Plains, where, generally, high average velocities prevail, the increase is much less, generally from 30 to 50 per cent.

CHARACTERISTIC WINDS.

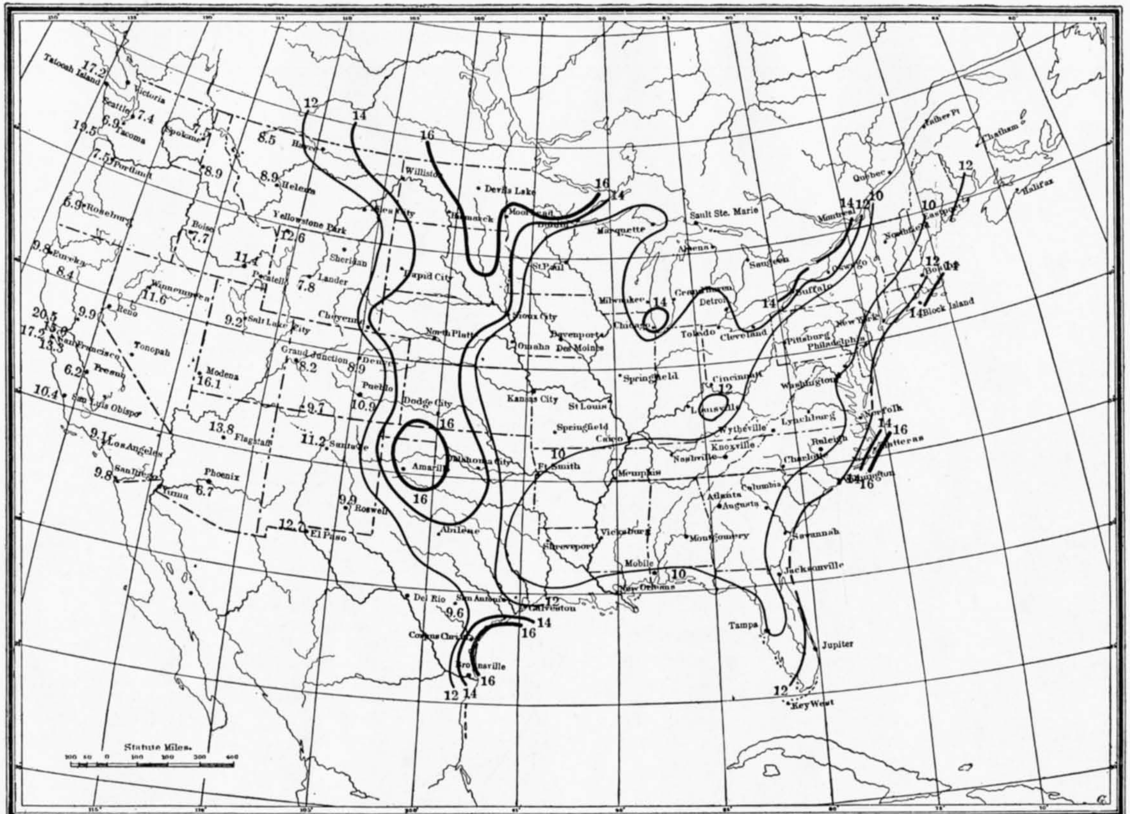
The geographical location of the United States is such that the greater part of its territory lies within the path of the general westerly winds common to its latitudes, and but for the obstructions offered by the mountain ranges, hills, etc., the influence of the large bodies of water, and the variations of atmospheric pressure due to the movements of cyclonic and anticyclonic storms, the surface winds would exhibit a general movement from some westerly point, save over the extreme



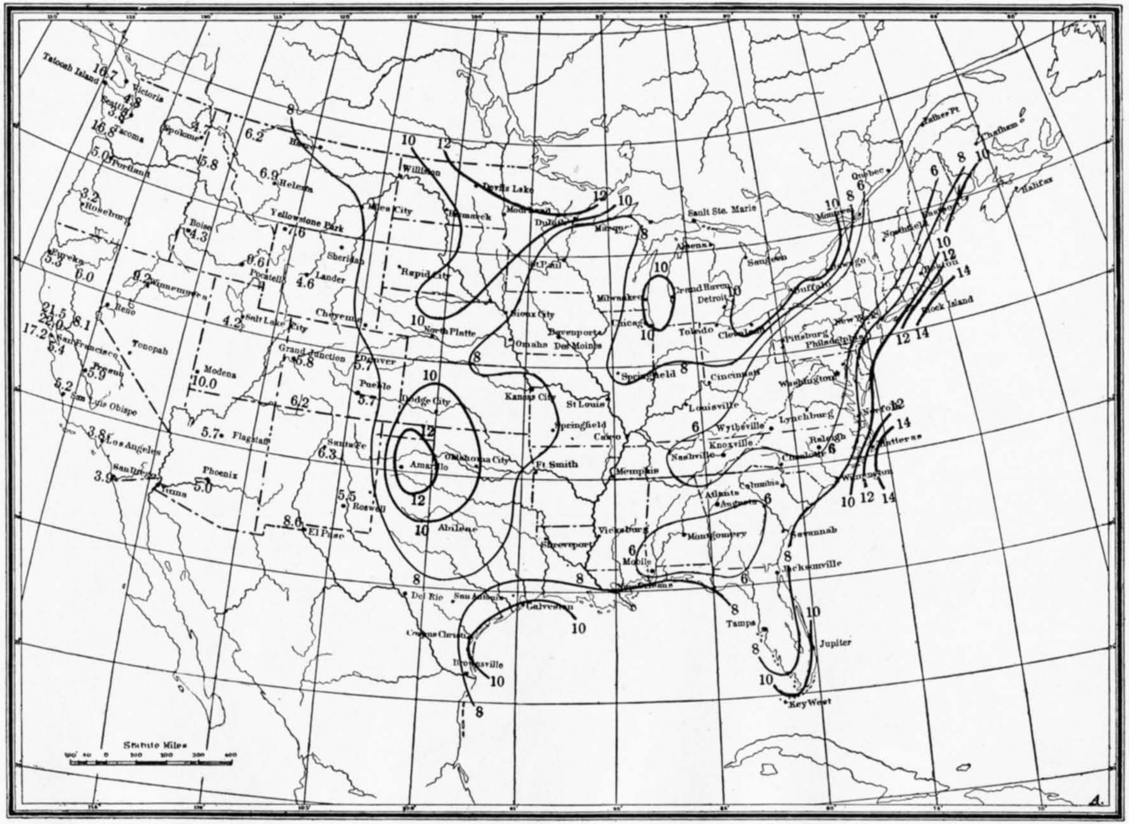
AVERAGE HOURLY VELOCITY OF THE WIND. ESTIMATED FOR ELEVATION OF 100 FEET.



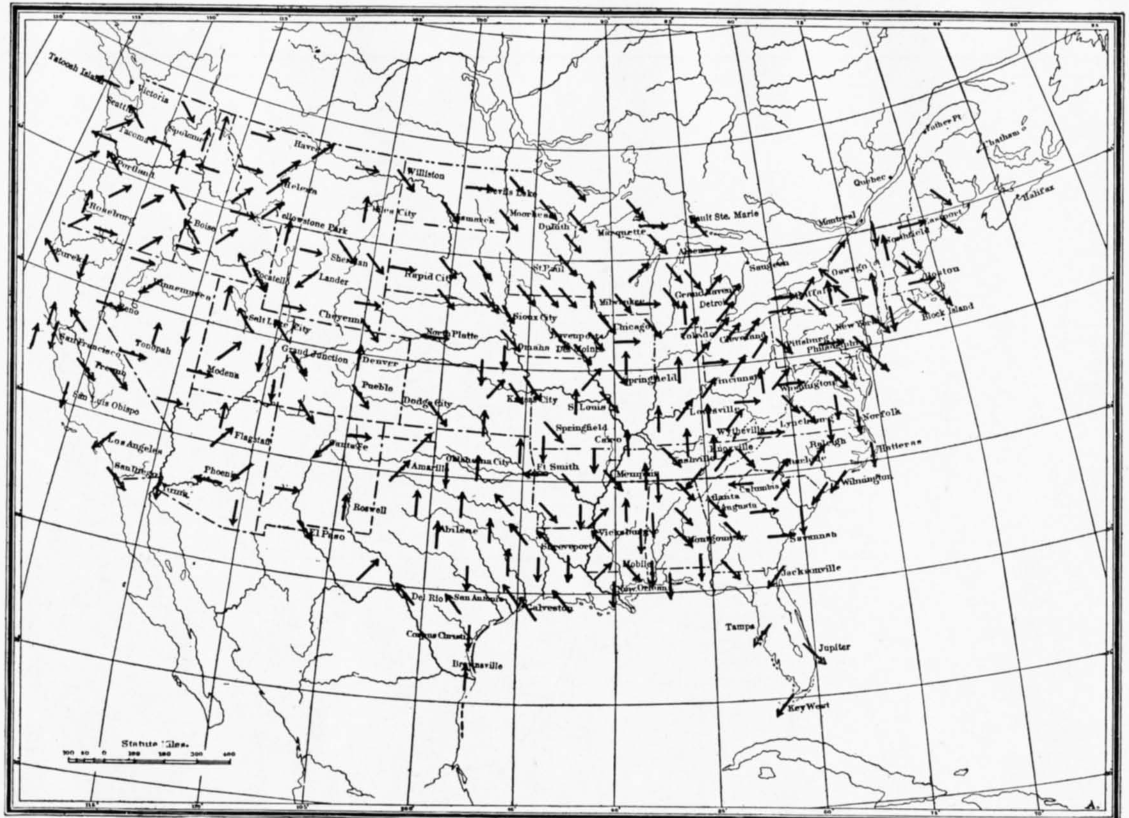
Average Hourly Velocity of the Wind, Daylight Hours, 6 a. m. to 6 p. m., Local Standard Time.
Estimated for Elevation of 100 Feet.



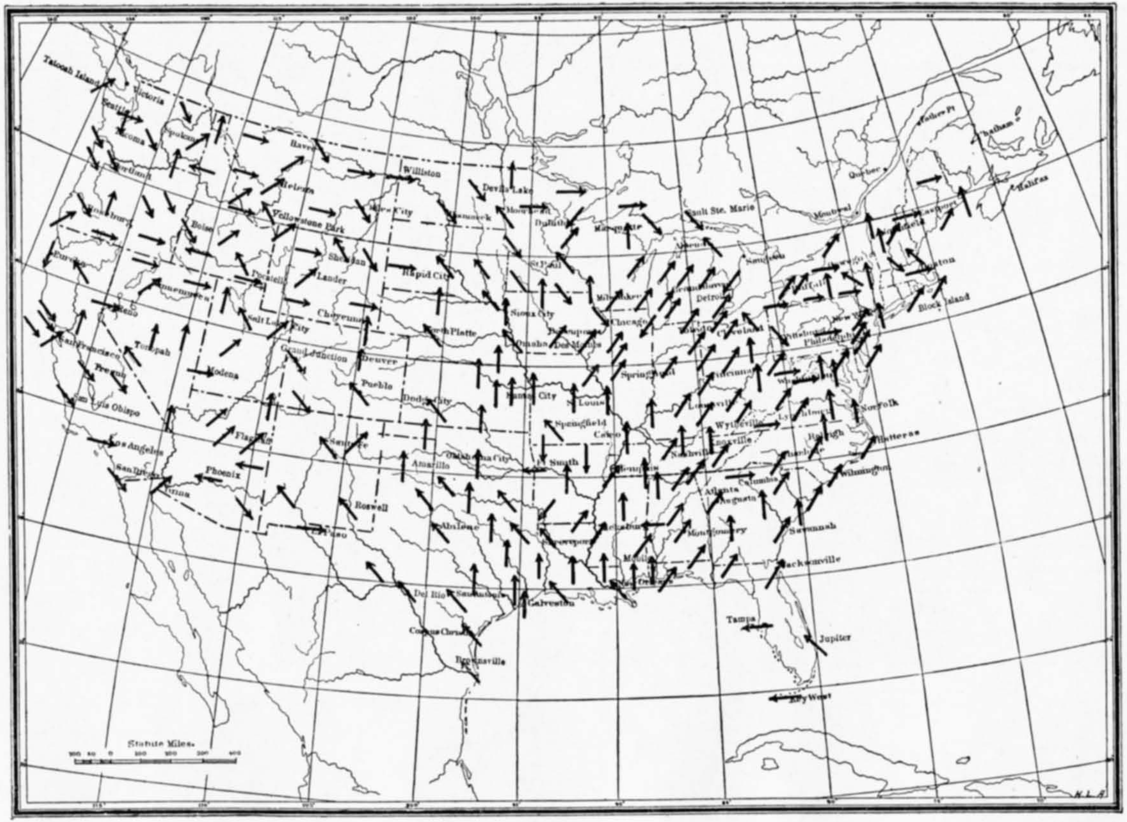
Average Hourly Velocity of the Wind at 3 p. m., Local Standard Time, the Approximate Hour of Greatest Wind Movement. Estimated for Elevation of 100 Feet.



AVERAGE HOURLY VELOCITY OF THE WIND AT 6 A. M., LOCAL STANDARD TIME, THE APPROXIMATE HOUR OF LEAST WIND MOVEMENT. ESTIMATED FOR ELEVATION OF 100 FEET.

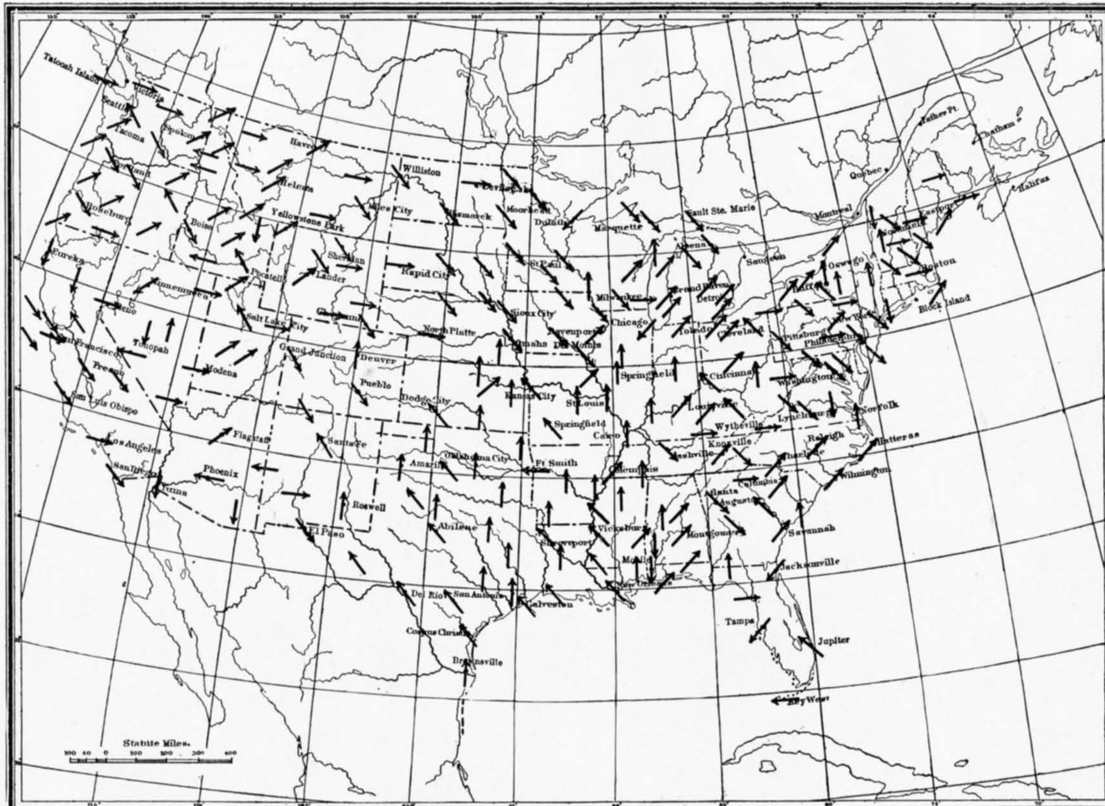


PREVAILING DIRECTION OF THE SURFACE WINDS, JANUARY.



PREVAILING DIRECTION OF THE SURFACE WINDS, JULY.

PLATE XXIX.



PREVAILING DIRECTION OF THE SURFACE WINDS, FOR THE YEAR.

southern portions, where the northeast trade winds prevail at certain periods of the year. On account of these interferences with the general drift of the atmosphere, there are developed systems of winds more or less persistent as to seasonal occurrence and geographic limits.

The different rates at which the land and water surfaces absorb and lose the sun's heat cause, near the shore line of large bodies of water, the well-known land and sea breezes, and we have these reversals of wind movement in the immediate vicinity of the several coasts and in the lake region. The prevailing trend of the wind along the coasts is, however, from some westerly point, except along the Gulf and south Atlantic coasts, where the effect of the trades begins to be felt, and the trend is from the south and east.

In the northern Plains region and upper Mississippi Valley west to north winds prevail, penetrating well into the middle plains and middle Mississippi Valley during the colder months of the year, but receding far to the northward during the summer months.

In the west Gulf and southern Plains regions southerly winds predominate, their sphere of influence, however, extending far to the northward and northeastward with the advance of the warm season; in fact, by midsummer they prevail throughout the entire country east of the Rocky Mountains, save for small areas from the northern mountains eastward to the Great Lakes, where they continue from the west or northwest. With the return of winter they recede to the southward, and by January their sphere of influence is largely limited to the southern Plains region and portions of the Ohio Valley.

On the Pacific coast, save for the rather slight land and sea breezes, the winds are normally from some westerly point, while in the mountain regions the winds, though generally from some westerly point, are nevertheless greatly modified by local environment.

SPECIAL WINDS.

In addition to these more or less permanent winds there are others uncertain as to occurrence but possessing such marked features as to have assigned to them names which are supposed to denote something of their character.

Among these may be mentioned the "blizzard," an occasional winter visitor to the northwest region, intensely cold and of high velocity, sweeping suddenly from the northward over the Great Plains and upper Mississippi Valley, and in exceptional cases extending far to the southward and eastward, sometimes lasting for several days, in other cases of short duration only. These storms are frequently accompanied by snow and sleet, and the frozen ice crystals, driven by the fierce strength of the wind, together with the accompanying severe cold, force man and beast to quickly seek shelter or face probable death.

Directly opposed to this terror of the Northwest is the "chinook," a warm and generally dry wind, peculiar to mountain regions, but in this country applied to certain winds of winter that occasionally occur in the northern Rocky Mountain and other northern regions, their influence at times extending far into the surrounding plains.

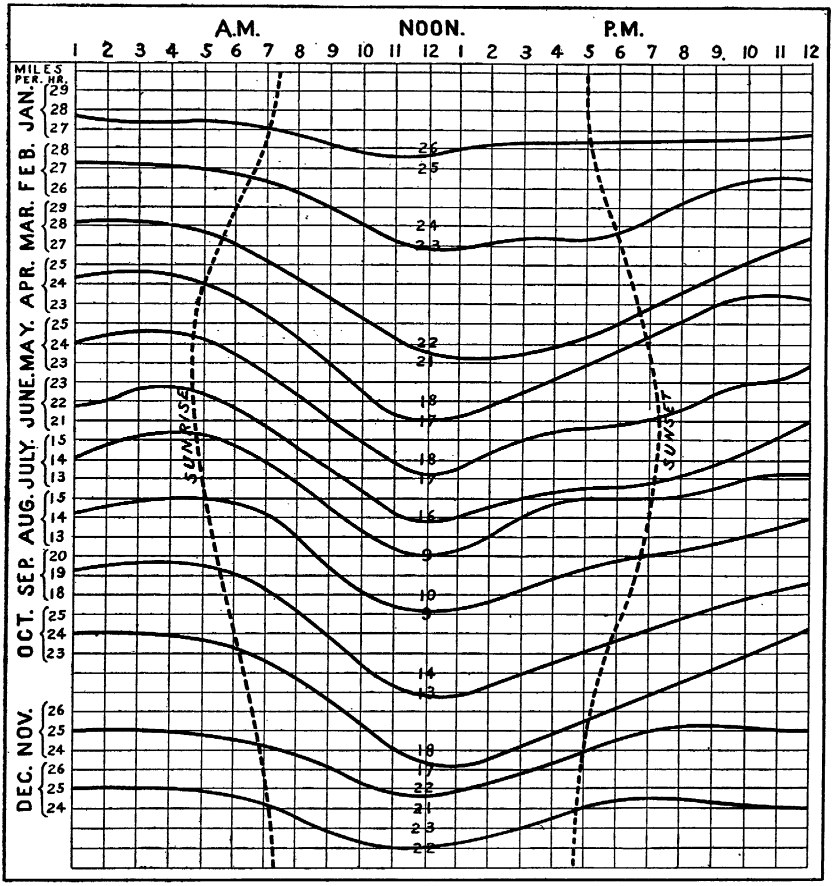


FIG. 11.—Diurnal march of the wind at an elevated station, Pikes Peak, Colo. Local standard time.

These winds frequently follow within a short period after the occurrence of a blizzard, and the first gentle touch of their warmth is like a summer zephyr as compared with the intense cold that may have been previously prevailing. They begin usually as light breezes, but frequently increase to high velocities, their warmth and general dryness rapidly melting or evaporating the accumulated snow and making it possible for domestic or other animals, exposed without shelter, to secure food and obtain rest from their fight against the cold. Were it not for the occasional occurrence of these warm winds animal life could not survive the severe winters of that region without special protection and an adequate supply of stored food.

Over the southern Plains region and sometimes extending into the middle Plains States, occasional "hot winds" occur during the warmer months of the year, blowing generally from the southwest with considerable force, and in extreme cases they have been described as similar to a blast from a hot furnace, absorbing the moisture from the soil and literally drying vegetation as it stands in the fields. Immense damage may be caused in a few hours by these winds at critical periods of crop growth and development, and if continued over several days, as sometimes happens, the suffering to human and animal life from the abnormally heated atmosphere may be intense, and the damage to crops so widespread as to constitute a National calamity. A similar dry, hot wind, the "Santa Ana," occurs at intervals in portions of California, blowing from the north, however, and occasionally causing much damage to vegetation.

ECONOMIC USE OF THE WIND.

Space in this paper will not permit of showing all the uses to which the winds may be put economically to serve the needs of man, but it is hoped the accompanying charts will furnish the means whereby those seeking information as to the possibilities of utilizing their force as a cheap source of power may have before them some of the more important details as to the average rate of motion in the different portions of the country, the time during which certain velocities may be maintained, their prevailing directions, etc.

Air in motion is a vehicle of energy whose power depends upon its rate of movement. It has been a potent agent in the work of leveling the mountains and filling the valleys of the earth by sweeping from the one to the other the loose fragments of rock disintegrated by the action of the elements, and great areas of the earth's surface have been covered to varying depths by this action. It transports the moisture from the sea to the land, watering the earth and forming the rivers. It scatters the seeds of plants and trees far and wide, and thus fosters the distribution of vegetable life.

In our own country the westerly winds, laden with moisture evaporated from the wide expanse of the Pacific, deposit their load largely on the sides of the Sierra Nevada and Rocky Mountains and their outlying ranges. Much of this moisture falls as snow and the winds sweep and pack it into the depressions, where it lies till late in summer, furnishing a supply of water to feed the streams and reservoirs used to irrigate the large areas of orchard and garden in the valleys below. East of the mountains the southerly winds of the spring and summer transport the moisture evaporated from the Gulf of Mexico to the Great Plains and Mississippi Valley regions, where, in the form of rain, it waters the great cereal and grass producing areas. Likewise the valleys and hills of the eastern districts are watered in turn by the moisture-laden winds from the Great Lakes, the Gulf, and the Atlantic.

Man has made use of this force to a greater or less extent from the earliest periods of history by harnessing it to perform useful work. The development of a knowledge of its power may be observed by comparing the rude sail raised by primitive man to assist him in propelling his dugout across a small stream or from island to island with the full-rigged ship of the present day, as she proudly moves from some great harbor, laden with a mighty cargo, to cross the widest ocean. Likewise may we compare the cumbrous wooden windmills of the earlier settlers of our own country with the powerful steel mills of the present day.

The uncertainty of continuous or sufficient wind movement when urgently needed has always militated against a more extensive use of this natural source of power in labor-saving devices, but there is much work that can be economically performed by the wind had we a better knowledge of the regions where its force and constancy are such as to warrant the development of its power.

While the windmill as a power producer appears to be in successful operation in nearly all parts of the country, there are certain sections where the average wind velocity near the earth's surface is so low that only the very lightest character of work can be accomplished, and during much of the time no work at all is possible. On the other hand, there are large areas where its strength is such that mills may be relied upon to furnish power of large volume and with considerable constancy.

LOCALITIES FAVORABLE FOR SUCCESSFUL USE OF WINDMILLS.

The greatest field at the present for the successful use of the windmill as a power producer must be found upon the farms and in the smaller communities farthest removed from other sources of cheap power producers, and with the increasing cost of wood and coal the use of the windmill as a producer of heat, light, and power must ever increase.

A study of the several charts of average wind velocity discloses many regions where the movement, during the working hours of the day, or in some cases for the entire day, is sufficient to insure the generation for much of the time of sufficient power to perform many of the lighter forms of work on the farm or in the household, and thereby warrant the expense of installing the necessary apparatus.

In the Great Plains region of the West, where the lack of rainfall, even under the most favorable conditions of improved tillage, the conservation of the soil moisture, and the growing of drought-resistant crops renders general farming operations somewhat hazardous, it is essential that small areas at least shall be made practically immune from drought by the practice of irrigation. Water may be found at no great depth from the surface in nearly all these regions, and the installation of a small pumping plant operated by wind power will enable the small or large farmer, at little cost, to irrigate a few acres of garden or orchard, thus assuring himself against a total failure of foodstuffs in years of extreme drought. In fact, there are but few portions of the country where intensive farming is practiced that a small irrigating plant maintained by wind power would not at critical periods, when from lack of moisture immense damage might occur, prove a valuable adjunct to the more extensive field operations. Along nearly the entire coast line of the country, at the higher elevations in the mountain districts, and over much of the great prairie regions of the country the velocity of the wind during some portion of the day is nearly always such as to produce power sufficient for the lighter forms of work.

DEVICES FOR OBTAINING ELECTRICAL ENERGY FROM WIND POWER.

One of the most promising fields, however, for the future successful development of power from the use of the windmill lies in the possibilities of successfully generating and storing electrical energy, which may be used later for the heating and lighting of country or suburban homes, charging electrical motor cars, working agricultural machinery, cooking and other household work, and pumping water for irrigation purposes. Electric turbines of this character are now in successful operation, especially in England, and there is evidently a wide field of usefulness open to them in this country, especially in view of the fact that it is probably feasible to connect a number of mills to a single storage battery, thereby greatly increasing its power capacity, and at the same time it is possible to store up the energy generated during periods of abundant power for use during intervals of lack of wind.

Other devices for the development of electric power from the winds provide that, in order to insure the delivery of a certain amount of energy constantly, the windmill shall be supplemented by a combustion-driven engine, the principle being that when the wind is sufficiently strong the electrical generator will be driven by that power alone; when the velocity falls to a point insufficient to cause the generator to deliver the output required, the engine is automatically started and continues to drive the generator until the wind velocity has again reached a point where it can deliver the required power, when the combustion engine is automatically cut out and shut down.

The accompanying charts should prove valuable in showing the portions of the country where such outfits might be economically and successfully installed.

THE WINDS AND AVIATION.

One of the greatest uses of the wind in the past has been in the navigation of the seas, but water is not man's natural element, and after ages of effort it is now apparent that the navigation of the air, man's natural element, is assured.

The information shown on the charts herewith relative to the wind velocities and directions near the earth's surface should be of interest to aviators, especially as to the periods of the day when the air is least disturbed by ascending or descending currents.

The effect of the increasing heat of the sun as the day advances is to warm up the earth's surface and the layers of air resting thereon. As heated air expands and therefore becomes lighter it rises, and there are set up during the hours of sunshine ascending currents which rise in height proportional to the degree of heating. In the summer time the height to which these currents ascend may be indicated by the tops of the cumulus clouds which are formed by the condensation of the moisture in the surface air, which, as it rises to the higher elevations, cools sufficiently by expansion to form clouds. With the approach of night the earth cools rapidly and likewise the layers of air resting thereon. This cooling causes contraction, and as air from above descends to fill the space there results a general descending movement of the atmosphere during the night hours. This night motion is not so pronounced, however, as the ascending day currents, and the vertical stability of the air is greatest during the coolest part of the day.

It is especially important that aviators should escape these ascending and descending currents as far as possible. This can be accomplished in a measure by rising to the higher elevations during the heated portions of the day, while during the early morning and late afternoon hours it is feasible to fly much nearer the earth's surface.

The accompanying charts of average wind velocity and prevailing direction should prove valuable in selecting localities best suited for experimental work in aviation.

THE WATER ECONOMY OF DRY-LAND CROPS.

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INTRODUCTION.

Success in dry-land agriculture—crop production without irrigation in regions of limited rainfall—depends largely upon two factors: (1) Maintenance of the largest possible supply of soil moisture and (2) growing crop plants which can adjust themselves to the occurrence of drought. Such plants may be obtained by introduction from other countries having a similar climate or they may be developed by plant-breeding methods. As a rule a combination of the two measures is necessary, since it rarely happens that an introduced variety is so well adapted to conditions in its new home that it can not be further adjusted by selection. Both lines of work can be carried on more effectively if we know just what habits of growth and what peculiarities of structure adapt plants to dry-land conditions. To point out some of these adaptations is the purpose of this paper.

WHAT IS MEANT BY THE TERM "DROUGHT."

The word "drought" is usually taken to mean "dry weather," but when used in connection with plant life it requires further definition. Even when no rain falls and the air is excessively hot and dry, few, if any, crop plants are likely to suffer from drought if the soil is kept supplied with water by irrigation. From an agricultural point of view drought may be defined as a deficiency of soil moisture, usually accompanied by atmospheric conditions favorable to a high rate of evaporation. Dry-land farming is practiced in regions where drought is frequent but not continual, hence where the supply of soil moisture is alternately abundant and scanty. Crop plants are therefore required which can adjust themselves to such alternations.

WATER AS A FACTOR IN PLANT GROWTH.[1]

Before we can discuss intelligently the means by which plants succeed in localities where drought occurs, we must have a clear conception of the relations of water to plant life in general. Every

[1] This subject has been treated more fully in a paper by B. T. Galloway and A. F. Woods, entitled "Water as a Factor in the Growth of Plants," in the Yearbook, U. S. Dept. of Agriculture, for 1894, pp. 165–176.

South American companies and establishments producing refrigerated meats for export.

Name of company.	Capital stock (gold) 1912.	Name of establishment.	Location.
The River Plate Fresh Meat Co. (Ltd.).	$2,250,000	Campana	Province of Buenos Aires.
Compañía Sansinena de Carnes Congeladas.	4,500,000	La Negra	Do.
Do		Cuatreros	Do.
Do		Frigorífica Uruguaya	Uruguay.
Las Palmas Produce Co. (Ltd.)	2,500,000	Las Palmas	Province of Buenos Aires.
Compañía Argentina de Carnes Congeladas.	1,500,000	La Blanca	Do.
La Plata Cold Storage Co. (Ltd.)	5,000,000	La Plata	Do.
Frigorífico Montevideo		Montevideo	Uruguay.
The Smithfield and Argentine Meat Co. (Ltd.).	1,250,000	Zãrate	Province of Buenos Aires.
Sociedad Anónima Frigorífico Argentino.	2,000,000	Argentino	Do.
The New Patagonian Meat Preserving and Cold Storage Co. (Ltd.) (branch of La Plata).	2,608,607	Río Gallegos	Patagonia.
Do		San Julian	Do.

Regarding the United States ownership in the above South American refrigerating companies, from our present information it may be stated that the two establishments, La Plata and Frigorífico Montevideo, the latter in Uruguay, with the two branches in Patagonia, are owned by the Swift Company; the La Blanca plant is owned by Morris & Co. and Armour & Co., and the Frigorífico Argentino has been leased by the Sulzberger Company.

The following table shows the exports of Argentine refrigerated meat since the commencement of the trade. The increase in chilled beef with a corresponding decline in frozen beef exports in recent years shows a growing preference for the former. The great bulk of the exports has gone to England.

Different species and varieties of plants differ greatly in the activity of their transpiration. In regions of ample rainfall and in arid regions where irrigating water is available these differences are of relatively small agricultural importance, since there is usually moisture sufficient for the needs of the most wasteful plants. But where severe drought is of frequent occurrence, ability to control transpiration is an important factor in successful plant growth.

WATER REQUIREMENT.

The degree to which a plant is economical in its use of water is expressed in its water requirement, or the total quantity of water which it expends in producing a pound of dry matter. Water requirement can not readily be determined in the field, but a method has been devised for measuring it under such conditions that the relative efficiency of different species and varieties can be accurately determined.

The two essential features of this method are (1) growing the plants in large vessels with a volume of soil sufficient to permit the plants to behave normally and to mature a crop and (2) sealing the surface of the soil so as to prevent direct evaporation, thus avoiding loss of water except through the plants themselves. Conditions as to temperature and atmospheric moisture are the same as in the field. Provision is made for supplying daily or at frequent intervals the water lost by transpiration, a careful record being kept of the total quantity added during the course of the experiment. Knowing the quantity of water present in the soil at the outset and at the conclusion of the experiment and the total quantity added during its progress, it is a simple matter to calculate the total quantity expended by the plants. The total weight of dry matter produced is ascertained by weighing the plants as soon as they are harvested and thoroughly dried. With these data in hand the quantity of water which has been used in producing a pound of dry substance can be readily calculated.

Experience has shown that with proper care a great variety of crop plants can be made to grow thriftily and to yield large quantities of straw and of seed under these experimental conditions. Hence, there is every reason to believe that the comparative water requirements of different crop plants may be accurately determined under any given climatic conditions and that we may safely infer from the results what species and varieties are most economical in the use of water. Other things being equal, the best plants for dry-land agriculture are those which produce the greatest weight of dry matter in proportion to the quantity of water transpired.

MEANS BY WHICH PLANTS SUCCEED UNDER DRY-LAND CONDITIONS.

The term "drought resistant" is usually applied to all plants which can grow without irrigation in regions where the soil is frequently deficient in moisture. Yet, as a matter of fact, many of these plants do not "resist" drought in any strict sense of the term. It is more correct to say that successful plant growth under the conditions mentioned depends upon ability either to endure, to evade, or to escape drought.[1]

ADAPTATIONS FOR ENDURING DROUGHT.

Endurance of drought implies ability to maintain life when the soil is so dry that practically no absorption of water by the roots can take place. Plants may endure drought if they are able to store water in their own bodies or are able to remain alive in a dormant condition.

Storage of water.—Many plants inhabiting deserts or other very arid situations are characterized by thick, fleshy leaves or by swollen stems and roots. These thickenings are due to the presence of numerous layers of cells which have the property of storing water during rainy periods and giving it up slowly, when the soil becomes dry, to the cells which carry on the work of assimilation. Long after the soil has become so dry that absorption of water by the roots has virtually ceased such plants may continue to grow, living upon the water accumulated in their tissues much as a camel can live for days without drinking by utilizing the water stored in its stomach. The various cacti which are so characteristic of American deserts, some of which are useful forage plants, afford excellent examples of water storage. This adaptation is not developed to a noteworthy degree in any of the more important crop plants.

Ability to become dormant.—Many desert shrubs and trees pass the greater part of their lives in a leafless condition, putting forth leaves only during the brief and infrequent rainy periods. Such plants endure drought just as most northern trees and shrubs endure the rigors of winter, by virtue of their ability to remain alive without growing, i. e., in a dormant condition. Plants while in this condition make very little demand upon the soil moisture, their transpiration having practically ceased.

This adaptation reaches its highest development in the case of seeds and of those mosses and lichens which can revive quickly when wetted even after having become so dry as to fall into powder when rubbed between the fingers. Some of the most important of the

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[1] That some such distinction should be drawn has been suggested by A. M. Ten Eyck in a paper entitled "Drouth Resistant Crops" (Dry Farming Congress Bulletin, vol. 3, 1910, p. 369), and by C. R. Ball, "The Importance and Improvement of the Grain Sorghums" (Bulletin 203, Bureau of Plant Industry, 1911, p. 22).

grasses which make up the range or native pasture in arid regions, such as the grama grass and buffalo grass of the Great Plains, are likewise able to remain alive in a very dry condition and to resume growth promptly when water again becomes available.

A tendency in this direction is shown by various orchard and forest trees, by alfalfa, and by the sorghums. These plants can withstand considerable drought by virtue of their ability to become partly dormant.

ADAPTATIONS FOR EVADING DROUGHT.

Evasion of drought implies ability to make economical use of a limited supply of water. The plant which can control or reduce its transpiration does not rapidly exhaust the available moisture and hence may avoid a condition of drought in the mass of soil from which its roots draw water, even at times when drought is prevalent in the locality. The same advantage may also be secured by an exceptionally well-developed root system, which permits the plant to draw water from an unusually large mass of soil.

CONTROL OF TRANSPIRATION.—Plants differ greatly in the rapidity with which they lose water, the rate being inversely proportional to the ability of the plant to control its transpiration. Such control may be attained either by retarding the transpiration per unit area of leaf surface or by reducing the total area from which the loss of water takes place. Closing the breathing pores, or stomata, is a direct and very effective means of retarding transpiration. Various peculiarities of structure, especially marked in plants of arid regions, are regarded by botanists as additional means for hindering the loss of water. Among these may be mentioned: (1) Leaves so constructed that the margins can roll in, forming a sheltering chamber into which the stomata open; (2) stomata confined to the lower surface of the leaf; (3) stomata situated at the bottom of pits or furrows instead of being level with the general surface of the leaf; (4) a dense feltlike or scaly covering of hairs; (5) a thick impervious cuticle or a coating of wax over the surface of the leaves and stems.

Many plants which inhabit deserts are characterized by dwarf growth or by the small number and size of their leaves. In such cases the loss of water is limited by the smallness of the total transpiring surface. A still further step in the reduction of transpiration is taken by such trees and shrubs as regularly shed all of their leaves during periods of drought.

With such extreme reduction of transpiration as we find in the native plants of arid regions, the rate of growth must be very slow and the annual production of vegetable matter must be small. It follows that few cultivated plants show conspicuous adaptations for the control of transpiration, although such adaptations are found in a modified degree in those varieties of many crops which thrive best under dry-land conditions. Wherever such adaptations exist, their tendency is to retard the exhaustion of the soil moisture within reach of the roots and hence to postpone the occurrence of drought.

EXCEPTIONAL ROOT DEVELOPMENT.--Plants differ greatly in the characters of their root systems. Some species are characterized by roots which penetrate deeply into the soil, while others possess roots which lie near the surface. The root system can be more or less modified by environment and is particularly susceptible to the influence of changes in soil moisture and soil texture. Yet there is always a limit to the amount of possible modification, and in most species the type is sufficiently fixed so that the best development of the roots and consequently the best growth of the plants are attained under some particular combination of soil conditions.

Ability to evade drought is often due to having roots developed in such manner as to absorb water from an unusually large mass of soil. Whether a shallow or a deep root system is most effective depends largely upon the character of the soil and upon the distribution of the rainfall.

If water penetrates readily to a considerable depth, plants having deep roots are obviously at an advantage as compared with shallow-rooting species. Such roots can push ahead into moist soil as fast as the surface layers dry out. In the virgin condition, soils which have this distribution of moisture are largely occupied by deep-rooting woody plants, such as the characteristic black sage (*Artemisia tridentata*) of the Great Basin region. Alfalfa with its long taproot is a good example of this adaptation among cultivated plants.

On the other hand, if the soil is so shallow or the rainfall so scanty that moisture is ordinarily held in only a slight depth of soil, deep-rooted species can not thrive. Here the advantage is with plants like the surface-feeding trees, which extend their roots horizontally for long distances. The olive as described and figured by Mason [1] affords a good illustration. This tree, when growing without irrigation in regions of very limited rainfall, develops long roots which radiate almost horizontally from the crown, producing a great many fine branches at a depth of only a few inches below the surface of the ground. This is an ideal arrangement for taking up rapidly the water afforded by infrequent light showers.

ADAPTATION FOR ESCAPING DROUGHT.

Plants which have so short a growing period that they can mature before the season of drought begins may be said to escape drought. It is one of the striking features of arid regions that when the rains

[1] Mason, S. C. Drought Resistance of the Olive in the Southwestern States. Bulletin 192, Bureau of Plant Industry, 1911. See especially figures 7 and 8, p. 29.

commence a host of small annual plants spring into life. These so-called "ephemeral" plants are able to germinate, complete their growth, and ripen seed in a very few weeks, so that their chances of reaching maturity before the soil dries out again are exceptionally good. No cultivated plants have so brief a span of existence as these desert "ephemerals," but we may properly compare with them certain quickly maturing varieties of "small grains" which are well adapted to dry-land agriculture in regions of summer rainfall. In crop plants which have this habit of life, marked efficiency in the absorption and conservation of water is of comparatively little importance. They owe their success to their rapid growth, which enables them to ripen seed in a comparatively brief time. Often they are no more exposed to actual drought than are crops grown under irrigation in the same region.

COMBINATION OF ADAPTATIONS.

Most of the crop plants which succeed under dry-land conditions possess more than one of the adaptations just described. Thus, alfalfa is in a measure drought enduring, owing to the ability of the crowns to become partly dormant, and it is also well adapted to evade drought by means of its deeply penetrating roots. The varieties of small grains which are best adapted to growing without irrigation in semiarid regions not only have a short growing season, which enables them often to escape drought, but have also a relatively small total leaf surface, a character which favors drought evasion by reducing transpiration and thus diminishing the danger of exhausting the soil moisture.

The sorghums afford what is perhaps the best example among crop plants of a combination of adaptations for meeting drought. They are typically drought evading, but have also considerable power to endure drought. Sorghums are exceptionally well adapted to dry-land agriculture in regions of summer rainfall like the Great Plains. The plants grow slowly during the first few weeks after germination. This might be regarded as a disadvantage, since in the Great Plains the moisture content of the soil is usually greater at this time than at any other season of the year. The atmospheric humidity is also usually greater, and consequently the plants transpire less and have a lower water requirement than is the case later in the summer. But this disadvantage is compensated by the fact that the slow early growth results in conserving the soil moisture and makes it possible for the plants to evade drought during the remainder of the season. Such crop plants as grow rapidly from the start exhaust the available soil moisture much earlier in the season and if a drought occurs may fail to mature, while sorghum will continue its growth for a considerably longer period. If the drought continues, their ability to become partly dormant enables the sorghum plants to remain alive in a wilted condition for several weeks, resuming growth when rain comes. Consequently this crop is often in a position to utilize the rainfall of the entire growing season. The sorghums have considerable ability to control transpiration, as is shown by the fact that the plants wilt but slowly when the water supply is cut off. This contributes to their ability to evade and, in extreme cases, to endure drought. Finally, they have a low water requirement, being exceptionally efficient in the production of a crop with a relatively slight expenditure of water.

ADAPTATIONS TO DROUGHT AS AFFECTING CROP PRODUCTION.

The typical drought-enduring plants, those which have a marked ability to store water or to become dormant, are admirably equipped for maintaining life under arid conditions, but because of their very slow growth are not as a rule suited for crop production. It is even doubtful whether such plants are as efficient in their use of water when available as are many plants which have no marked capacity to withstand drought.

On the other hand, a limited degree of drought endurance, such as is shown by the sorghums, by the crowns of alfalfa plants, and by many trees, affords insurance against total loss of crop during briefer periods of drought and need not prevent profitable production. In seasons when the rainfall is normal as to total quantity but very irregular in its distribution these crops may finally give good yields, while corn and potatoes, for example, which have less ability to become dormant, may fail utterly. In fact, no perennial plant and no annual having a long growth period can be considered a safe crop for dry-land agriculture unless they are in some degree drought enduring.

But in the main the success of dry-land crop plants is due rather to ability to evade or to escape drought than to drought endurance. Control of transpiration, unless carried to an extreme, and exceptional root development, the two most important means for evading drought, may be quite compatible with satisfactory yields. Likewise, plants which escape drought by having a short growing season and completing their development while moisture is abundant may be well adapted to profitable crop production under dry-land conditions.

The degree to which a plant is successful in enduring, evading, or escaping drought measures only its ability to maintain life and to reproduce itself. To insure profitable crop production the plant must also be able to produce a large quantity of organic substance. In regions where the quantity of available soil moisture is often small this can be attained only by plants which produce a satisfactory yield with a relatively small expenditure of water; in other words, by plants which have a low water requirement. This is especially true in the case of drought-evading crops, which make their growth during the season when drought is likely to occur and which depend for success upon their ability to use water so economically as to avoid a deficiency of moisture in the soil around their roots.

AGRICULTURAL PRACTICE AND ADAPTATION TO DROUGHT.

By proper cultural methods it is possible to imitate some of the natural adaptations to drought. This applies only to adaptations for evading and for escaping drought, since endurance of drought is due to inherent properties of the plant alone and is entirely independent of agricultural practice.

EVASION OF DROUGHT.

Plants can be greatly aided in evading drought by reducing the amount of growth per unit of soil mass. Other things being equal, the amount of growth made under dry-land conditions will be limited by the quantity of water available. Hence, if measures are taken to avoid having the stand so thick or the growth so heavy that the soil moisture will be rapidly exhausted by excessive transpiration, there is much more likelihood that the remaining plants will reach maturity. Various methods are available for reducing the amount of plant growth to the limit of safety.

THIN STAND.—In extremely arid regions the native shrubs and trees generally stand far apart, so that each individual has a large mass of soil from which to draw water. The same advantage may be secured artificially by thin planting. Many crop failures in arid regions are caused by a too thick stand. The ideal should be to have no greater number of plants per acre than can be brought to maturity by the moisture supply which may reasonably be expected.

Perennial crops like alfalfa and trees should be planted so thin that even during the most unfavorable years the plants may successfully evade drought. An admirable example of adjustment of planting distance to moisture supply is afforded by the dry-land olive orchards of southern Tunis, in a district where the annual rainfall averages about 9 inches.[1] Although only from 7 to 11 trees are planted to the acre, profitable crops of fruit are obtained with much regularity.

With annual crops the rate of seeding should be governed as far as possible by the moisture supply of average years. Yet the stand, especially of grain crops, is not entirely controllable by the rate of

[1] Kearney, T. H. Dry-Land Olive Culture in Northern Africa. Bulletin 125, Bureau of Plant Industry, 1908.

seeding. Too abundant moisture during the early period of growth, even though thin seeding is practiced, may result in failure of the crop by stimulating the plants to unusually heavy stooling. The excessive loss of water by transpiration from the dense growth thus produced may lead to a fatal deficiency of soil moisture before the grain is ripe.[1]

The crop can obtain the full benefit from thin planting only where the land is free from weeds. With intertilled crops this condition may be met by clean cultivation. When intertillage is not practiced, as is usually the case with small grains, little or no advantage is likely to be obtained by thin seeding in case the land is foul. The more favorable moisture condition thus created leads to a vigorous growth of weeds and a correspondingly rapid exhaustion of the water supply. As a result the crop may not have as good a chance to ripen as would have been the case had the grain been sown thickly.

Cutting or pruning.—In the case of tree crops, the top should be kept small as a protection against total exhaustion of the soil moisture during periods of drought. As a general rule the older and larger a tree becomes, the greater is the danger of its death from drought. This danger may often be averted by judicious pruning. Clean intertillage is recommended for an orchard or woodlot thus managed, since otherwise the water economized by reducing the total leaf surface of the trees would merely be diverted to the use of the grass and weeds.

Perennial forage crops, such as alfalfa, may be safeguarded against drought by cutting when a serious shortage in moisture supply threatens. If the greater part of the transpiring surface is removed, the plants will be able to continue growing for a much longer period than if the crop were left uncut, and, if there is sufficient rainfall later in the season, they may produce a good second or third crop.

Growing dwarf varieties.—There are certain varieties of crop plants which have an inherent tendency to limited growth. By the choice of such dwarf varieties it may be possible to prevent overproduction and thus bring the crop to maturity, where a larger variety having a greater transpiring surface might exhaust the soil moisture long before growth is completed. Some of the most successful crop varieties of the Great Plains area, such as Dwarf milo and other dwarf sorghums and the smaller growing varieties of oats and barley, are cases in point.

[1] The disastrous effects sometimes observed when manure is applied in dry-land farming may also be due to overstimulation of the plants and consequent premature exhaustion of the soil moisture.

ESCAPE FROM DROUGHT.

Annual crops which have a comparatively brief growing season, such as the spring grains, may be enabled to escape drought if seeding is so timed that the maximum growth will take place during the period when rainfall is heaviest and evaporation is least. Sometimes the crop may be grown so as to evade drought at one season and escape it at another. A good example is winter wheat. In regions of summer rainfall, such as the Great Plains area, water is conserved in the soil by clean cultivation throughout the summer and the seed is sown in the fall. The stored moisture is sufficient to enable the crop to evade drought during the fall and winter and to start growth early enough in the spring to escape the severe droughts of the middle and late summer. On the other hand, where rain comes mostly in winter the plants escape drought during the wet winter months and by economical use of the water left in the soil at the close of the rainy period are able to evade drought during the spring and summer.

CONCLUSIONS.

Plant introduction and plant breeding in connection with dry-land agriculture should be guided by the nature of the adaptations to drought possessed by the crop in question. The following points should always be considered:

(1) Season of growth and length of the growing period.

(2) Ability to endure drought by becoming more or less dormant.

(3) Character of the root system as determining the distribution of soil moisture to which the plant is best adapted.

(4) Adaptations for controlling transpiration.

(5) Smallness of the water requirement as determining efficiency in crop production.

In dealing with a plant which has some ability to endure drought, whether a perennial like alfalfa or an annual having a rather long growing season, such as sorghum, the comparison should be made under conditions of actual drought, selection being based upon the ability of the plants to survive and to give a profitable yield after having experienced a deficiency of soil moisture. Since adaptations for postponing or evading drought are equally important in crops of this character, the nature of the root system and the means for controlling transpiration should also be studied. In the case of rapidly maturing annuals like the small grains, attention should be given to the length of the growing season, upon which depends the ability of the plants to escape drought. In all cases the water requirement should be investigated, a low ratio of water expenditure to crop production being one of the best indications of adaptability to dry-land conditions.

Much of the plant breeding and variety testing which has been carried on in semiarid regions with a view to obtaining "drought-resistant" crops is open to criticism on the score that too much attention has been paid to the highest yielding plants. Often the work has been done in seasons of unusually favorable rainfall. Often the largest and most productive plants in a field have been selected without attempting to determine whether these have not been favored by a larger supply of moisture or of plant food in the soil immediately around their roots. Varieties thus developed are not likely to prove safe for crop production under average conditions. Allowance must be made for the fact that nature has set limits to the yields attainable in dry-land agriculture. In the last analysis these are determined by the quantity of water available. The varieties which prove safest for growing in regions where drought is frequent will almost inevitably be less productive than varieties of the same crop which are more exacting in their water requirement.

On the other hand, the agricultural value of dry-land plants is not determined by their water economy alone. Since the ultimate object is profitable crop production, the yield and the quality of the product must not be overlooked. If selection is focused exclusively upon adaptability to drought conditions there is danger that the variety obtained will prove so inferior that it can not be profitably grown.

A compromise between the two ideals will generally give the best results. The plants to be selected are those which in one way or another are reasonably secure from destruction by drought and which also, when grown under conditions of moisture supply normal to the region, can give a product that will be remunerative to the grower.

THE BUSINESS ASPECT OF NATIONAL FOREST TIMBER SALES.

By T. D. Woodbury,
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THE PURPOSE OF TIMBER SALES.

The National Forests of the United States and Alaska contain approximately 600 billion feet of timber, board measure, with a present value exceeding $500,000,000. The harvesting of such of this timber as is mature, in a way to secure a second crop, and under such limitations as the needs of a reserve for future supplies and of water-shed protection impose, is one of the principal functions of the Forest Service.

The importance of this work has increased rapidly during the last few years. During the fiscal year 1905 the timber cut in sales on all National Forests amounted to only 68 million feet board measure, while during the fiscal year 1910 the amount so cut was approximately 380 million feet board measure, or more than five times as great. At present more than 5,000 operators are engaged in cutting this timber.

HOW TIMBER SALES ARE MADE.

National Forest timber for which application has been received is examined by a competent officer, who reports the character, species, and amount found, and the amount that may be cut in accordance with the principles of forestry; and furnishes a map showing the topographical features of the area, the patented lands, and the boundaries of the proposed sale. This examiner also investigates carefully the probable cost of the operation per thousand feet board measure and the selling price of the finished product, and recommends a stumpage price which shall be fair both to the purchaser and to the United States. The terms of the sale are then included in a formal application for the signature of the applicant, who deposits $50 to cover the cost of advertising for a period of 30 days, as required by law. After the expiration of the period of advertisement the sale is awarded to the successful bidder by means of a formal contract which contains the clauses outlined in the application. A reasonable bond is required to secure compliance with the terms of the agreement. After the first advance payment has been made, the timber is marked for cutting by the forester in charge of this phase of the work (Pl. XXX), and the purchaser begins operations.

In large sales the Forest Service is represented on the ground by men with wide experience in lumbering, who regulate the woods work of the operation and decide mooted points of minor importance which come up from time to time. Scalers are employed by the Government to measure the timber cut (Pl. XXXI), and the operator's advance payments are made periodically upon the basis of their reports. A systematic check is kept upon this scaling to insure accuracy.

PREFERENCE IN TIMBER SALES.

In the sale of timber from National Forests the necessity for supplying local demand is always given first consideration, and the entire business procedure in small sales has been shaped with this end in view. Sales of timber not exceeding $50 in value may be made without delay by Forest officers whom the supervisor in charge of a National Forest designates. The applicant consults the nearest Forest officer, who selects the area from which the timber may be cut, marks such green trees as may be removed, and, after having explained the conditions of the sale, allows cutting to proceed as soon as he knows payment for the timber has been forwarded to the designated United States depository. Sales of timber between $50 and $100 in value are handled in a similar manner, except that the supervisor only may approve the agreement which must precede cutting. Among the users of the National Forest there is a large class who make a business of cutting cordwood, shakes, posts, pickets, or similar material for purely local demand. This procedure of a direct purchase is especially well adapted to such enterprises, since they are conducted upon a very small capital that must be turned frequently. In fixing the stumpage charge or rate set for the timber in sales of this nature consideration is given to the small size and local character of the enterprise.

SALES TO LARGE OPERATORS.

The amount of timber sold for purely local consumption, however, is trivial as compared with that disposed of to large operators, who sell the higher grades of their product in outside markets. This class of purchasers usually has established operations in large bodies of privately owned timber. In the course of their cutting areas of National Forest stumpage are encountered which they can handle economically, and which they generally apply to purchase. Recently, also, considerable interest has been evinced by lumbermen in operations conducted entirely in National Forest timber, and a number of applications have been received for the purchase of timber ranging from 500,000,000 to 1,000,000,000 feet in amount. Bodies of timber which will yield this cut are usually those which entail a large initial investment in railroads and equipment.

ADVANTAGES AND DISADVANTAGES.

From a business standpoint there are several advantages and disadvantages in large operations in National Forest timber. But the disadvantages at most are slight as compared with the advantages, and are made even less conspicuous by a careful and equitable adjustment of the stumpage rate by the Forest Service.

PILING AND BURNING REFUSE.

The disadvantages are certain items of expenditure which are peculiar to such sales. The principal one of these is the expense of piling the limbs and refuse after cutting, which is required of all operators as a fire protective measure. These accumulated brush piles are burned periodically, either in the fall or spring, and thus the cutting areas are kept in such shape that a chance fire will have but little material to feed on. (See Pls. XXXII and XXXIII.) The cost of brush piling to the operator varies from 15 to 40 cents per thousand feet board measure. In large timber in which the trees have a long, clear bole free from limbs, this work, if handled efficiently, can be done for the former figure; in small timber having little or no clear length and a dense crown or top the cost sometimes runs as high as the latter figure.

INCREASED COST OF LOGGING.

Another item of expenditure which is peculiar to sales of National Forest timber is the additional cost of logging, brought about principally by the necessity of leaving on the area certain timber which the lumberman, when working on his own land, ordinarily removes. These trees are left for additional growth before cutting, to furnish seed for a second crop of timber, and to protect the soil from drying out to such an extent that young growth could not get a start. Ordinarily trees which are allowed to stand are rapidly growing ones which have not yet reached maturity, i. e., the age at which rapid growth ceases; therefore it would not be good business practice from the standpoint of the United States to cut them, although from the standpoint of the purchaser, who wishes to secure as much timber as possible from the area, it is desirable that they be removed. The additional cost of logging on National Forest land, as contrasted with logging on private land, where in most cases all of the timber is removed, has been variously estimated. It is felt more heavily in logging large timber, where chutes must be constructed and the logs hauled to mill by means of donkey engines, than in logging small timber which can readily be handled by horses without chutes or donkey engines. In the same way, it is greater in rough country, where flumes or costly railroads are necessary, than in a comparatively level country, where no flumes are needed and railroad construction is cheap.

As an example, let us suppose an area containing 600,000 feet board measure is to be logged under Government supervision. About 66 per cent, or 400,000 feet, would probably be marked for removal. Let us further suppose that the logging of this area requires the construction of 80 rods of chute at a cost of $120. On the basis of a cut of 400,000 feet the chute would cost 30 cents per thousand feet, whereas on the basis of the entire stand of 600,000 feet it would cost only 20 cents per thousand, a saving of 10 cents per thousand in this item of logging. The efficiency of donkey engines used in logging is also reduced somewhat by a reduction in the amount of timber derived from a specified area. A crew and engine that could yard 30,000 feet board measure per day on private land would probably not handle over 25,000 feet per day on National Forest land, because of the smaller number of logs per unit of area. This means an added cost of from 20 to 30 cents per thousand in this phase of the work. Therefore, aside from the cost of disposing of the brush from cutting, the reduction in the amount of timber secured from the area is the principal additional item of expense. Both of these items together usually add not more than from 50 to 75 cents per thousand to the cost of handling timber from Government land.

STUMPAGE RATES.

In the determination of stumpage rates these additional operating expenses are given full consideration. In fact, in negotiating with a prospective purchaser, a great deal of care is exercised to see to it that the stumpage rate bears such a relation to the other items of the cost of production that a fair margin of profit may be secured from the operation. The cost per thousand of felling the timber, the cost of logging, the cost of transportation to the mill, milling, piling on cars, interest on the investment, depreciation, and taxes are all determined with as much accuracy as possible. In addition, the approximate wholesale selling price on board cars at the mill is secured before the stumpage rate is fixed.

ADVANTAGES IN OPERATIONS ON NATIONAL FORESTS.

The disadvantage of the items of additional expense mentioned, even though they were not compensated by the reduced stumpage rate, would be more than counterbalanced by the distinct advantages of large operations in National Forest timber. Private purchase of an area of timber sufficient to maintain a long operation represents an investment of the cost price with accruing interest and taxes; whereas in a sale from National Forest land no similar initial investment is required, taxes on land and timber are eliminated, and interest charges practically so.

An example will make this plain. An investor wishes to enter the lumber business in the yellow-pine sugar-pine belt of the Western Sierras for a 25-year period, cutting annually 40,000,000 feet board measure. A billion feet of timber must be secured to give this length of life to the operation. To secure such an amount of timber about 100,000 acres of timberland must be purchased, which, even remote from transportation, could not be obtained for less than $25 per acre, or a total of $2,500,000. Interest must be paid on this initial investment. It may be assumed that each thousand feet of timber manufactured pays back its pro rata share of the investment, and hence that one twenty-fifth of the $2,500,000, or $100,000, is recovered each year out of the earnings of the operation. At the rate of 6 per cent, the interest charge would amount to $150,000 the first year, and thereafter decrease $6,000 annually. On this basis, however, simple interest for the 25 years, without compounding the annual payments, will amount to $1,950,000 at the end of the operation.

TAXES ON PRIVATE LANDS.

A further carrying charge is the tax on the land, which must be paid yearly for 25 years. Assuming a tax rate of 1 per cent, an assessed valuation of $15 per acre for uncut timberland and of $2 per acre for cut-over land, and that an equal area will be cut each year of the operation, the tax throughout the 25-year period will be equivalent to one-half on timberland at $15 per acre and one-half on cut-over land at $2 per acre. The resulting tax will average $1,000 per year on half of the area (50,000 acres) and $7,500 per year on the remaining half, an average annual tax of $8,500. The sum of this tax paid for 25 years, even without interest, will be $212,500. Added to the $1,950,000 interest on the original investment, the total carrying charge which the operation must pay on its timber becomes $2,162,500.

CUT-OVER LAND AS AN ASSET.

At the close of this operation the land remains as a doubtful asset. If the owner is fortunate he may be able to sell it for grazing purposes for $3 per acre, or a total of $300,000 for the 100,000-acre tract used in the illustration. Assuming that the land is sold at this figure, and deducting $300,000 from the $2,162,500 of accumulated interest and taxes, there is still the considerable sum of $1,862,500 to be added to the original cost of the timber.[1]

ESTIMATING STUMPAGE PRICE.

The stumpage price in a private operation is usually determined by dividing the total amount of timber purchased into the cost of the land and timber. In this case 1,000,000,000 feet of timber divided into $2,500,000 would give a stumpage rate of $2.50 per thousand feet. But to get the actual stumpage cost paid during the entire enterprise the carrying charges on the initial investment must be included. This will make a total of $4,362,500, or $4.36 per thousand feet.

In cutting on National Forests, on the other hand, there are no taxes to be paid, and instead of a large initial investment in timberland the purchaser makes payments periodically of from $10,000 to $20,000 in advance of cutting. Taking an operation of the same size as the one used as an illustration on private land—that is, one cutting 40 million feet per year—the interest charges will be as follows: Figuring a stumpage rate of $3 per thousand, which is a fair average for sales up to 100 million feet of readily accessible timber, made for 5-year periods or less, the annual payments for stumpage will amount to $120,000. These will be made in monthly installments of $20,000 during the six months of the logging season, for in the yellow-pine sugar-pine belt of the western Sierras cutting begins on about May 1 and continues until about November 1. The mill is usually operated for a somewhat longer period. The interest on each installment must be calculated from the time the money is turned over to the United States depository until the timber has been cut, milled, and sold. This period will generally not be over 6 months. Hence 6 months' interest at 6 per cent may be assumed to be required on every installment. The annual interest charges will be the equivalent of 6 per cent for 6 months on $120,000, or $3,600. This will amount to 9 cents per thousand feet.

Thus, while the initial cost of stumpage might be $2.50 per thousand feet on private land as compared with $3 for National Forest timber, the carrying charges would make the final cost of the private stumpage $4.36 per thousand feet, against $3.09 for National Forest timber. The difference of $1.27 is in favor of the operator on the National Forest.

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[1] In the above calculations simple interest has been used for the sake of clearness instead of compound interest, generally employed in forest problems. If compound interest were used, the balance in favor of the operator on National Forest land would be even greater.

MARKING TIMBER TO BE CUT IN A SALE ON A NATIONAL FOREST IN THE SOUTHWEST.

FOREST OFFICER SCALING, TALLYING, AND MARKING TIMBER CUT IN A SALE.

BRUSH PILED AFTER LOGGING ON A NATIONAL FOREST.

BURNING BRUSH ON A NATIONAL FOREST TIMBER SALE AREA.

TRANSPORTATION INVESTMENT.

If larger bodies of less accessible Government timber are purchased, a considerable investment in transportation facilities may be required. This investment, with its carrying charges for interest and taxes, will of course increase the actual cost of the stumpage in the same manner as is described in the foregoing discussion. The cost of developing transportation, however, may be fairly assumed as little or no greater than in the case of similar bodies of privately owned stumpage. It is always provided for in the initial stumpage appraisal by the Forest Service. While the stumpage rates in sales extending over more than 5 years will be readjusted from time to time, as discussed hereafter, there is every likelihood that they will remain below the final cost of private stumpage when the carrying charges on the initial investment are considered.

FIRE RISKS.

Another large consideration in favor of the purchaser of National Forest timber is that the fire risk is carried by the United States throughout the entire operation. Fire is always a great menace to timber operators and investors, against which no protection in the way of adequate insurance at reasonable rates has ever been offered. Some precautions are generally observed in the vicinity of mills, but in the woods operators on private land prefer to leave the matter to chance rather than to incur an additional item of expense for adequate protection. The operator on National Forest land, however, is guaranteed protection to a very large extent by the protective system of the Forest Service. If, in spite of this protective system, a fire destroys a portion of the timber under contract, the loss is borne by the United States. The only injury done the purchaser is the shortening of the life of his operation by the destruction of a portion of the stumpage under contract. Even this will not occur if other bodies of Government timber sufficient to make good the original contract are available.

METHOD OF ADJUSTING STUMPAGE RATE.

The business feasibility of an enterprise in National Forest timber is not determined by the stumpage rate alone. The maximum amount of timber to be offered for sale and the length of time allowed for cutting also have a great deal of weight. Contracts for the sale of timber at a fixed rate, extending over more than a 5-year period, are clearly objectionable from the standpoint of the Government. It is impossible to forecast the selling price of lumber, even approximately, for a longer period than 5 years; therefore no just stumpage rate for a longer period can be fixed.

Since large bodies of Government timber are often 50 miles or more from transportation facilities, sales within them can not well be made for short periods. No operator can afford to build a railroad costing a million dollars upon the assurance of only a 5 years' supply of timber. Sufficient timber and sufficient time for marketing must be allowed so that the original investment may be written off and a profit derived in addition. The problem, then, has been to fix upon an equitable method of adjusting stumpage rates at certain fixed periods during the life of a timber contract. There will be no objection to contracts of National Forest stumpage up to at least 500 million feet in amount and extending over 10 to 15 years if a satisfactory adjustment of stumpage rates from time to time can be agreed upon. A method of accomplishing this has recently been proposed which apparently presents a practicable solution of the problem. This scheme proposes that a readjustment of stumpage rates be made at 5-year periods throughout the life of each sale contract, and that the original stumpage rate be increased at each adjustment by 75 per cent of the difference between the f. o. b. mill selling price prevailing when the sale was initiated and the selling price on the date upon which the readjustment is made. This guarantees to the United States a fair stumpage rate and to the purchaser a fair profit throughout the entire life of the transaction. It is generally true that as the selling price of lumber increases the cost of production also increases somewhat, and for this reason 25 per cent of the increase in selling price during each period is assigned to the purchaser to cover a prospective increase in the cost of operation. As a further guarantee of a fair profit to the operator, provision has been made in three recent cases where current market prices were below normal for giving the purchaser the entire benefit of the first $2 increase in lumber values before the percentage division is applied.

THE PRESENT OUTLOOK FOR IRRIGATION FARMING.

By Carl S. Scofield,
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INTRODUCTION.

According to the returns of the Thirteenth Census, there are in the continental United States about 14,000,000 acres of irrigated land, or about 80 per cent more than existed 10 years ago. Public interest in irrigation development found expression in 1902 in the enactment by Congress of the National reclamation law, under which irrigation water has been provided for about 1,000,000 acres of land. Under private enterprise, with some aid from State and National legislation, a much larger acreage has been put under irrigation.

As a people we are optimistic regarding irrigation farming. The colonization of the newly irrigated lands has been rapid and has nearly kept pace with the construction of the irrigation works. At present very little irrigated land is open for homestead entry, though there is considerable land in private ownership that could be farmed more profitably if it were subdivided into smaller units.

Irrigation farming has become only recently an appreciable factor in American agriculture, and it is not yet a factor of great importance if considered only from the standpoint of the area involved. Accepting the estimate of 14,000,000 acres, the total irrigated land is but little more than one-third the size of the State of Iowa. To make this comparison, however, does an injustice to the real economic significance of the movement. It is not the sole purpose of irrigation to produce foodstuffs for our eastern and European markets; it serves also to provide homes on the land in a salubrious climate and to support the people engaged in stock raising and in developing the mineral wealth of the Western States.

During the earlier stages of irrigation development in this country the products of irrigation were largely consumed in local or near-by markets. These were often far from the producing centers of the East and Central West. With this advantage of position these products brought good prices. As the area of irrigated land has increased and as the total production has exceeded local demands, the surplus has had to seek outside markets, there coming into competition with the products of unirrigated land. This competition seems certain to bring about some readjustments in the methods of irrigation farming.

In communities that have reached this stage of development further progress must be made along different lines. It is desirable to anticipate these changes as well as to understand the conditions that are causing them, in order to avoid as well as may be any serious economic depression.

It costs more to produce a crop under irrigation than under rainfall. Consequently, unless the yields are larger or the prices higher, the margin of profit to the producer must be less with irrigation than without. It is a popular assumption that crop yields are much larger under irrigation than under rainfall, but it is doubtful if the data available warrant this assumption in so far as it applies to most of the staple farm crops. It would be manifestly unfair to make such comparisons on the basis of average yields from the two classes of land. The comparisons should be made rather between typical cases of productive land and good farming.

There are so many factors that affect crop production that it is not easy to make comparisons between widely separated regions either as to relative yield or as to the net profits of production. Too often the comparisons of yield are made between irrigated land and adjacent dry land to the great disadvantage of the latter. There can be no doubt that in many irrigated sections of the western United States the soils are so fertile and the climate so favorable that when irrigation water is applied bountiful crops may be secured. But profitable agriculture does not depend solely upon the successful growth of the crop. The costs of production and the relatively higher charges for transportation and distribution are very important factors. And, further, the prosperity of some of the irrigated sections of the West has been more largely due to increases in land values than to the profits of crop production.

The costs of crop production may be segregated into three groups: (1) The fixed charges, which include interest on the land investment, with taxes, or in lieu of these, land rental; interest on the investment for equipment, and depreciation charges; and, under irrigation, the cost of the water; (2) the labor cost of producing and harvesting the crop; and (3) the cost of getting the crop to market. Not infrequently some of these items are overlooked in determining the production cost that must be set off against gross return in estimating the net profits of an agricultural enterprise.

THE FIXED CHARGES OF IRRIGATION FARMING.

Because of the continuous and often rapid development of new markets and transportation facilities in our Western States, accompanied by an influx of new settlers, the market values of irrigable land have been continually shifting and with very few exceptions have increased rapidly during recent years. Under such conditions present land holdings represent a wide range of investment values. In fact, one of the conspicuous features of colonization on these lands is the large proportion of purely speculative purchases made by those who expect to raise prices instead of crops. As a result, that portion of the fixed charges which represents interest on the investment is variable and uncertain. For the individual who expects his chief source of profit from land investment to be an increased land value any discussion of agricultural problems or possibilities has but little interest. There is always, however, a last purchaser, and to him the relation of interest charge to crop return has a real significance. Not infrequently the overinflation of land values may become the most serious economic problem of an irrigated region. Land that represents an investment of $25 an acre, with a fixed interest charge of $2 an acre per annum, might yield a fair return in some low-priced staple crop, while the same land at $200 an acre, with a fixed interest charge of $16 an acre per annum, must be devoted to a high-priced crop unless it is to be farmed at a loss. Too often a new settler in a region overlooks this significant point.

The fixed charges for interest and depreciation on equipment, though often overlooked by the farmer, are very real items of expense. They are frequently less in an irrigated section than elsewhere, particularly where the climate is mild and inexpensive buildings will serve for sheltering stock and machinery. The charge for irrigation water is a factor peculiar to irrigated land, but is one not usually overlooked by the prospective colonist nor long forgotten by the actual settler.

THE LABOR COST OF CROP PRODUCTION.

There is very little satisfactory information as to the cost of crop production in different sections of the country, and none that permits direct comparisons between farming with irrigation and without.

Such items as planting and tillage should be much the same in both cases, but the preparation of the land, which includes leveling for irrigation, is often an important item of expense. The cost of harvesting crops may be in some instances less under irrigation, if not in actual labor at least in money, because of the lessened need for hurry to avoid rain or storm injury. In fact, the more favorable climatic conditions of an irrigated region are of considerable importance with many crops which are subject to injury by inclement weather during the period of harvest or of subsequent storage.

THE COST OF MARKETING CROP PRODUCTS.

Many of our irrigated sections are isolated and far from market centers. Any crop products not required for local use must go to outside markets and bear the expense of the freight and commission charges, which often greatly exceed the cost of production. In the case of perishable crops the risk of deterioration or loss in transit is also great. With all products which have large bulk in proportion to the price, the transportation charge is often a large part of the market value. In all cases where the production of a crop exceeds the demand for local consumption the local price at once falls to correspond to the distant market price, less the freight and commission charges.

When an irrigated region is first settled the local prices of staple-crop products, such as grain and hay, are often very high. The local demand for these products is due to the needs of incoming settlers, who must buy feed for their work stock until their own farms come into production. There are often other local demands, such as of those engaged in the construction of the irrigation systems or for feeding stock on adjacent range land or isolated mining camps. During the first years in such a section the local prices are based on the cost of products in some older producing section *plus* the freight. As soon as the local production exceeds the local demand, a complete reversal takes place and prices drop to a point which is determined by the outside market prices *less* the freight.

It is this period of readjustment to new market conditions that is the most serious economic crisis of a new irrigated region. It is then that the real and discouraging hardships of the new settler are felt, the time when water payments lapse, and the less persevering give up the struggle. This period of depression is a feature of the development of nearly every new irrigated section. It is sometimes long and sometimes short, sometimes light and sometimes severe. The relief from it comes in finding other crops or crop products that serve local purposes or those that are of higher value, so that they can bear the cost of transportation to outside markets and yet leave the producer a profit for his labor.

THE NEED OF SPECIAL CROPS OR INDUSTRIES.

The ultimate success of an irrigated section requires that its products be so special in character or in season as to escape the full competition of the unirrigated districts nearer the principal markets of the country or that their cost of production be enough lower to permit the additional freight charges. It is fortunately true that many of our irrigated regions enjoy such favorable climatic conditions as to permit the production of crops that thrive poorly or not at all under rainfall agriculture. Such crops as dates, figs, olives, English walnuts, and Egyptian cotton are preeminently suited to the irrigated sections of the Southwest. Certain truck crops, such as cantaloupes, asparagus, and Bermuda onions, may be put on the market from our southern or southwestern irrigated lands at a season when prices will cover the high cost of production and transportation. With many of the truck and fruit crops, however, the risk of heavy losses from fluctuating markets is so great that they are precarious ventures and should not be relied upon to furnish the regular income of the farm. Treated as incidental crops to be raised on a limited scale, they may constitute an important resource on each farm.

Many irrigated sections are situated in the midst of range lands devoted to raising cattle, sheep, and horses. Irrigated agriculture may supplement the grazing industry in a very profitable way. Live stock may be produced cheaply on the range, but the cattle and sheep need to finish their growth on grain and hay in order to bring good prices in eastern markets. Also, the most economical use of the range requires that the stock must be given some forage in addition to the range during part of the year, whether sent to market or not. Live stock ready for market is usually sufficiently high priced to bear the cost of long transportation, so that isolated irrigated regions can well compete with eastern lands in meat production. This is true particularly because of the fact that most irrigated land is well suited to alfalfa, which is one of the best meat-producing forage crops.

The natural conditions that favor meat production on irrigated lands also favor dairying. Such dairy products as butter and cheese find a ready market at any time and are so concentrated that transportation charges are relatively small. Wherever alfalfa thrives, and particularly where range land is accessible from the irrigated farms, dairying and the production of meat would appear to afford safe and moderately profitable returns for the labor and capital invested.

Much of the lure of western irrigated land lies in the novelty of that type of farming and in the hope of large and quick returns from intensive and highly specialized crops. To one who is discouraged in the struggle for a livelihood on some eastern farm or in a factory, office, or store the attractive picture of an irrigated orchard or alfalfa farm makes a strong appeal. Orchard fruits and truck crops are much exploited as a means of large profits in favored sections.

There can be no doubt that some irrigated lands are of such a character and so favored by climatic conditions that bountiful crops of fruit and vegetables may be secured. But many of the highly favored regions are small and definitely circumscribed. Many instances of successful crop production or of large profit from special crops are the result of unusual skill on the part of the producer or of exceptional market conditions. It appears certain that the irrigated lands of the West will meet keener competition than previously from eastern lands in the production of such fruits as apples, pears, and peaches for eastern markets. The present supremacy of western fruit seems to be due to the better methods of parasite control and of packing for market rather than to economy of production or superiority of quality.

On the whole, a general survey of the situation suggests that the sustained prosperity of our irrigated lands will depend upon development along one or more of the following lines: (1) Diversification of crops and development of local industries to such an extent that the raw crop products are largely consumed locally; (2) the production of special crops that can not be grown as well under rainfall or that may be sent to market in seasons when they are not available elsewhere; or (3) the production of larger crops of such high-priced products as can bear the cost of transportation to the general markets of the country.

THE DIVERSIFICATION OF CROPS.

Diversification of crops is essential to a permanent and prosperous agriculture, and this diversification should exist on the individual farm as well as in the community as a whole. The importance of diversification is recognized and practiced in every community that has been long established, even where the products of other sections are easily obtainable. Where a community is isolated diversification is still more important because of the high cost of transportation. The greatest economies in agricultural production are secured not where specialization is practiced, but where diversification of crops permits the most uniform and continuous employment of labor and where the larger proportion of the needed food supplies is produced at home. It is a deplorable feature of many new agricultural regions that a large proportion of the food supply is imported when it could be produced much more cheaply.

A high degree of specialization in farming is economically more feasible when a community is well established and where facilities for an exchange of products and a shifting of labor are highly perfected. In a new and isolated community, on the other hand, the best and most rational development is secured when a sufficient diversity of industries is practiced to supply the majority of the home requirements, to keep labor continuously and effectively employed, and to insure a revenue from some of the crops when the others fail.

Unfortunately, much of the exploitation of agricultural land in new regions is done on the basis of a single crop. Not infrequently investment is solicited under an arrangement whereby the land is to be planted to some perennial crop and cared for by the seller until the crop comes into production. Such schemes of exploitation have little to recommend them, even when carried out faithfully. The rigors of pioneering are not to be lessened that way. The profits in agriculture are seldom large and are assured only as a result of close personal attention, careful economy, and persistent effort. Nonresident ownership and operation permit none of these and are seldom, if ever, profitable.

Under ordinary conditions farming should not be looked upon primarily as a money-making occupation, but rather as a means of a fairly certain livelihood and an opportunity for home making. As a general thing, investment opportunities in agriculture are to be found in the increase in land values and are therefore of a speculative nature. Under favorable conditions farming may be expected to afford all of the necessities and some of the luxuries of life, and it favors the development of healthy, sane, and self-reliant citizens. These are the principal features and advantages of farm life with irrigation, as elsewhere, in new communities or in old ones. One whose chief desire is to accumulate wealth through the investment of money can usually find more profitable openings in some other line than farming.

THE PROSPECTS OF SUSTAINED PRODUCTIVITY.

The use of irrigation water as an aid in crop production is as old as history, but the history of irrigation is, with some exceptions, a story of rise and decline. There are some conspicuous instances, such as the Nile Valley in Egypt, where irrigation has been practiced continuously in the same region and probably on the same land for many centuries, and there are some oases in northern Africa and southwestern Asia where the practice of irrigation is probably very old. In general, however, irrigation on any particular tract of land has not been permanently and continuously successful. While this fact is a matter of common knowledge it is not clear that irrigated agriculture is peculiar in this respect. The successive rise and decline of agricultural industries in any particular region is one of the very definite, if somewhat obscure, features of history.

In the case of ordinary agriculture many profound changes take place without attracting much attention. A region may be for a period the scene of a flourishing and prosperous agriculture of one type and some years or centuries later be given over to some other type of crop production or used for pastoral purposes or even revert to its primeval forest condition. And these changes may go on without attracting much attention, or, if noted, be ascribed to some change in political or economic conditions. In any event, the shifting of agricultural enterprises where irrigation is not used may go on without leaving behind any conspicuous remains.

The shifting or abandonment of an irrigated agriculture is made more noticeable because the dams and ditches remain as a record for many years or even centuries. Thus, while it is a well-known fact that irrigated agriculture has been in the past not usually continuous and permanent, it is not so generally realized that unirrigated agriculture has also shifted from place to place. It is probably true that the changes of place made in irrigation farming have been more rapid and more abrupt than those of unirrigated farming. It appears further that, in some cases at least, irrigation has been definitely and permanently self-limiting and that land once irrigated and later abandoned has not again been used for crop production.

The causes that have contributed to the abandonment of irrigation in many of these regions are not well understood. It has been customary to assign such reasons as the decay of the irrigation works, the rise of alkali, disturbance of political conditions, or the degeneracy of the people. The fact remains that many ancient irrigation enterprises are now abandoned. Even here in America we find the remains of large prehistoric irrigation works in our arid lands with no satisfactory clues as to the causes of their abandonment.

Our modern irrigation development in this country is still too new to give very definite indications as to what may be expected in the future. Some disturbing symptoms have appeared in recent years on our older irrigated lands, but as a people we are going deeper into agricultural science than our predecessors, and it remains to be determined whether or not we can meet and overcome the difficulties that have caused failures in the past.

From the standpoint of the individual, the decline in productivity of irrigated land is not a matter of very acute interest if it is believed to be a matter of generations or of centuries rather than of years. Most people have only a casual interest in the welfare of posterity. But there are certain phases of this matter that are of acute interest to the individual irrigation farmer. There can be no doubt that what is known as the rise of alkali is a matter that may become serious in months as well as in centuries. It is a problem that is, or is likely at any time to become, acute on nearly every tract of irrigated land. It is a very complex problem, peculiar to irrigation farming and intimately affecting its prosperity and its permanence.

The so-called rise of alkali may be defined as the accumulation in the soil of soluble salts which are the products of soil weathering and disintegration. Whenever this accumulation becomes excessive these salts hinder or prevent the growth of crop plants. These salts seldom accumulate in harmful quantities where the rainfall is adequate for crop production, because they are usually leached out of the soil as fast as they become soluble.

If it were practicable to apply irrigation water in such a manner and in such quantities as to provide the crop plants with what they need and in addition to insure some percolation of water through the soil into the underground drainage, it seems probable that one of the most acute difficulties of irrigation would be overcome. But this is not easy to accomplish. In the great majority of cases the land is irrigated too little or too much. When irrigated too little the salts remain and accumulate in the soil, and when irrigated too much they are transported from one place only to come to the surface in another where the ground water collects. Thus the use of irrigation water under the ordinary conditions of farming results in serious disturbances in the normal equilibrium between the soluble and the insoluble constituents of the soil. And these disturbances are soon manifested by consequent derangements in the nutrition of the crop plants.

It is the consensus of opinion among irrigation engineers and others familiar with the situation that the chief cause of these difficulties is the excessive use of water. It is obvious that where the natural drainage is inadequate and where artificial drainage is not provided the excessive use of water must result in swamping the land. But there are some very good indications that the so-called alkali or plant-nutrition difficulties are not to be avoided merely by restricting the use of irrigation water. Where irrigation is so restricted that there is no drainage there may result an accumulation of salts that in time will cause trouble. This condition may be brought about either through the weathering or disintegration of the soil, through the deposition of the soluble salts carried by the irrigation water, or by an accumulation near the surface of salts which were originally distributed more evenly throughout the soil. If this view of the situation is correct it is apparent that merely restricting the use of irrigation water will not prove an insurance against alkali troubles.

The diversification and rotation of crops which involves different methods of tillage and varying quantities of water on the land from year to year promises to retard, if not to prevent, the development of some of these difficulties. Unfortunately, many of the special crops best suited to irrigation farming are perennial crops, some of which occupy the land for many years, and with their use systematic rotation is not possible. It becomes necessary, therefore, to work out for these perennial crops methods of planting, tillage, and irrigation that will give some of the benefits of crop rotation. These methods involve, among other things, the maintenance of a supply of organic matter in the soil and at least the occasional percolation of water through it.

Aside from cases where alkali or seepage water is the obvious cause of a decline in the productivity of irrigated land, there are other causes of decline that are not well understood. The evidence thus far available indicates that the deterioration of irrigated land may be due in some cases to obscure diseases of the plants or to some derangement of the processes of nutrition rather than to a lack of fertility as that term is understood in agriculture under rainfall. Whether or not there is inherent in irrigation agriculture a set of adverse conditions other than those related to the rise of alkali remains to be determined. In any event there is reason for believing that many of our irrigated districts may long continue in a high state of productivity because the available land so much exceeds the available water that when any particular tract of land becomes unproductive the water may be carried to new land at small additional expense. But such shifting of water to new land must often result in some individual hardships where a farmer has all his capital invested in the land that is abandoned.

While there can be no doubt that the soils of many of our irrigated regions are at first very productive, an exaggerated idea of their productivity is often given by making the comparison with adjacent arid lands or with conspicuously unproductive lands in the humid regions. The only fair comparison is to be made with the soils of similar character and in regions where the rainfall is adequate for crop production. But the initial high productivity of irrigated land is not a very important asset unless the system of farming is such as to maintain a high production. The agricultural experience of the race has been that the diversification of crops and the feeding of live stock on the farm are the surest means to that end. There is no good evidence that this experience will not apply quite as well to irrigated land as to any other.

SOME ECONOMIC ADVANTAGES OF IRRIGATION FARMING.

In some of the preceding paragraphs attention has been called to some of the disadvantages of irrigation farming, when such farming involves the production of the staple crops of the humid regions in excess of local demands. There are many real advantages enjoyed by irrigated lands, and it is by the development of these that irrigation farming may be expected to prosper.

In the production of a few crops irrigated lands have practically a monopoly. For such crops the economic problem is chiefly to encourage increased consumption by our people generally. Such fruits as figs, olives, and dates might very well be consumed in much larger quantities in this country, and Egyptian cotton is so much superior in quality to our Upland short-staple cotton that it should be used more extensively in manufacture than is possible with the present source of supply. This increase in consumption is best encouraged by steadily increasing production and working out cheaper methods of distribution.

With some other crops the certainty of production each season is rather greater under irrigation than under rainfall, and this advantage may more than offset additional transportation charges. With still other crops the market price is so high that transportation charges become relatively negligible.

Probably the most distinct advantage enjoyed by some irrigated sections is due to location. When situated in the midst of extensive range lands upon which live stock may be grown more cheaply than elsewhere, an irrigated section finds a continuous and profitable market for grain, forage crops, and foodstuffs. This is also true when adjacent areas are developed by dry farming. A large proportion of the mineral wealth of the country is found in the arid regions, and whenever irrigation development is possible near these centers of production ready and profitable markets are assured. The favorable climatic conditions of some of our arid regions have induced many people to live there for reasons of health and comfort, and as the general prosperity of the country increases a larger proportion of the people will move to these favored sections. This movement will be encouraged by the continued extension of irrigation farming, with its consequent increase of supplies of food. Some of the finest parts of the country have been accessible only to people who could subsist out of tin cans.

The general tendency on irrigated land is toward intensive farming, with a small acreage for each family. This brings farmhouses closer together and permits the maintenance of better roads, better schools, and improved social conditions. As the general development of the country goes on there is no apparent reason why some of our irrigated sections should not support manufacturing industries, to the mutual benefit of both agriculture and manufacture.

CONCLUSIONS.

The area of irrigated land in this country has nearly doubled in the last decade, and the products of these lands are in an increasing number of cases more than enough to supply the local demands in the regions where they are grown. Many of our irrigated areas are isolated, and all crops or crop products not consumed locally must be shipped to outside markets, often to compete with crop products grown without irrigation. It costs more to produce crops under irrigation than it does under rainfall, and the yields of staple crops on irrigated land are not usually much larger than those on unirrigated land in favorable locations.

The price of irrigated farm land in the West is generally increasing, so that much of the colonization of these lands is based on a prospective rise in land values rather than on prospective crop production. Artificial inflation of land values is a menace to the prosperity of many irrigated districts.

The labor cost of producing irrigated crops is generally greater than that of unirrigated crops, though this fact is not fully realized by many prospective settlers.

In the normal course of development irrigated sections must usually pass through a period of economic depression resulting from the production of crops in excess of local demands. Early attention to finding crops that can bear the cost of shipment will do much to lessen the duration and severity of this period.

In order to avoid disadvantageous competition with crops from unirrigated land it is desirable to develop special industries or crops for our irrigated lands and to take advantage of local conditions by supplementing the production of live stock from the range lands.

The diversification of crops on the individual farm and in each irrigated section is very important in order to utilize labor effectively as an insurance against crop failure and to maintain the fertility of the soil.

The history of irrigation farming shows the need of giving careful attention to the use of water, to securing adequate drainage, to the diversification of crops, and to the production of live stock in order to avoid a decline in crop production.

Irrigation farming in this country has some distinct economic advantages, due to the location of the areas in the midst of range lands or near large mining enterprises or centers of trade. Some of our irrigated lands have a mild climate and a long growing season which permit the production of crops that do not thrive elsewhere in this country. It is by development along these lines of natural advantage that the prosperity of irrigation farming is to be expected.

COMMERCIAL METHODS OF CANNING MEATS.

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INTRODUCTION.

Modern canning methods may be said to date from the year 1795, when Nicholas Appert, a Frenchman, invented a process for preserving foods in hermetically sealed receptacles. Prior to this time drying and salting were the only methods employed to any extent for the preservation of foods.

Appert's process consisted in inclosing the articles to be preserved in glass jars, which were then corked and exposed to the action of boiling water in open kettles for varying lengths of time according to the nature of the article treated. Appert's process may be summed up in his own words, as follows:

> It is obvious that this new method of preserving animal and vegetable substances proceeds from the simple principle of applying heat in a due degree to the several substances, after having deprived them as much as possible of all contact with the external air. It might, on the first view of the subject, be thought that a substance, either raw or previously acted on by fire, and afterwards put into bottles, might, if a vacuum were made in those bottles and they were completely corked, be preserved equally well as with the application of heat in the water bath. This would be an error, for all trials I have made convince me that the absolute privation of the contact of external air (the internal air being rendered of no effect by the action of heat) and the application of heat by means of the water bath, are both indispensable to the complete preservation of alimentary substances.

While Appert had no conception of the rôle played by micro-organisms in the spoilage of foods, his experiments clearly showed that a vacuum alone was not sufficient for the preservation of foodstuffs, and that the application of heat and the subsequent exclusion of the outside air were essential to their successful preservation. We now know that the air contains micro-organisms or germs which are responsible for the fermentation and putrefaction of foods.

The stimulus which prompted Appert's investigations was a prize offered by the French Government for a method of preserving foods for the use of the navy, and in 1809 the inventor was awarded the prize of 12,000 francs. The process was given to manufacturing firms in France and was soon carried to England.

At first the secret of the process was carefully guarded, but in time the employees of the different establishments became more or less familiar with the details of the process and in this way the method was carried from England to America about 1815 or 1818.

Ezra Daggett, originally in the employ of an English firm, is said to have first brought the secret to America, and as early as 1819, in partnership with his son-in-law, Thomas Kensett, was engaged in the packing of hermetically sealed food in New York City. Lobster, salmon, and oysters were among the first goods packed in America, but by 1825 fruits and vegetables were also canned.

In the early days of the canning industry glass jars were used, but owing to their bulkiness, cost, and easy breakage they were gradually abandoned for tin containers, which first came into use in 1825, when Thomas Kensett secured a patent on the use of tin cans in preserving food. The cans were at first made entirely by hand, and their early manufacture was crude, costly, and tedious, the making of 100 cans being considered a good day's work. The introduction of labor-saving machinery, however, has greatly lessened the cost of production, and the manufacture of cans has now become a distinct industry, although it is estimated that about 10 per cent of the cans used are still made by the canning establishments. Cans are now made entirely by machinery by means of complicated machines which cut the different parts and fit and solder them together, turning out the finished can with almost incredible rapidity. A single machine can now turn out as many as 90,000 cans in a day.

In the original Appert process the goods were cooked in open kettles in boiling water, 212° F. being, of course, the highest temperature obtainable. Later on higher temperatures were obtained through the addition of sodium and calcium chlorid to the surrounding water.

In 1874 A. K. Shriver, of Baltimore, invented a closed kettle for cooking the goods by superheating water with steam, and in the same year G. W. Fisher, also of Baltimore, invented an improved kettle in which dry steam was used, the principle being the same as that of the modern autoclave. By these methods, which are still in use, any desired temperature may be obtained and the time required for processing is materially reduced.

While the canning industry was established on a commercial basis in this country as early as 1825, it has only been within the last 25 or 30 years that the industry has become one of much importance. At first there was considerable skepticism on the part of the public in regard to the healthfulness of canned goods, and a more or less widespread prejudice existed against their use. This prejudice, however, has now largely disappeared, and the cost of production

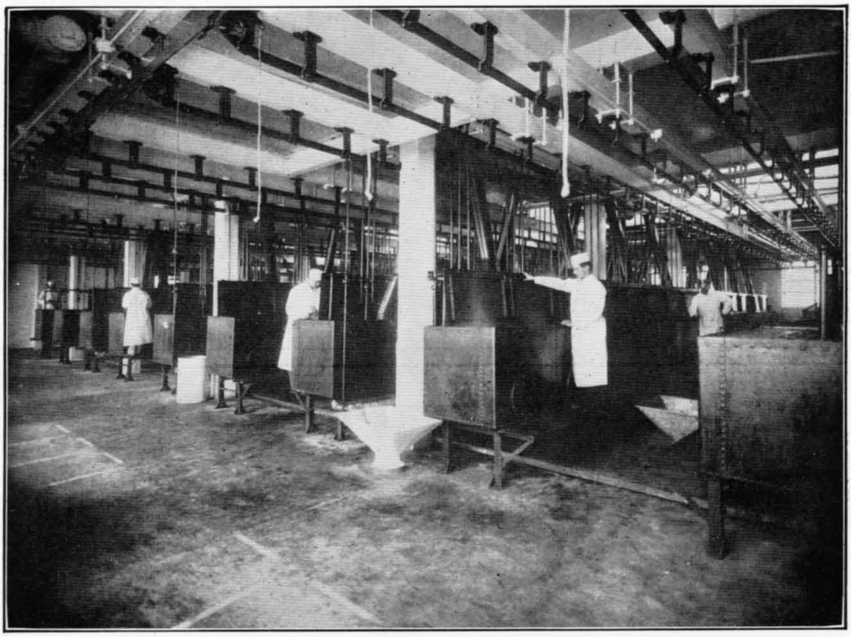

FIG. 1.—COOKING ROOM IN MODERN CANNING ESTABLISHMENT.

FIG. 2.—PREPARING CORNED BEEF FOR CANNING.

[Government inspector at center. Cutting machine shown at left.]

FIG. 1.—PREPARING PIGS' TONGUES FOR CANNING.

[Government inspector in foreground at right.]

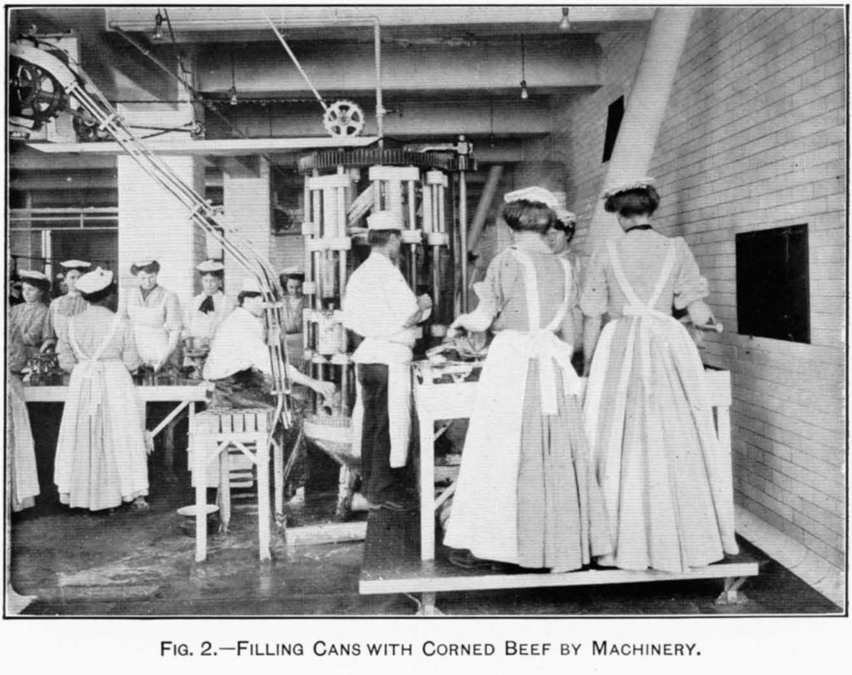

FIG. 2.—FILLING CANS WITH CORNED BEEF BY MACHINERY.

FIG. 1.—CAPPING THE CANS.

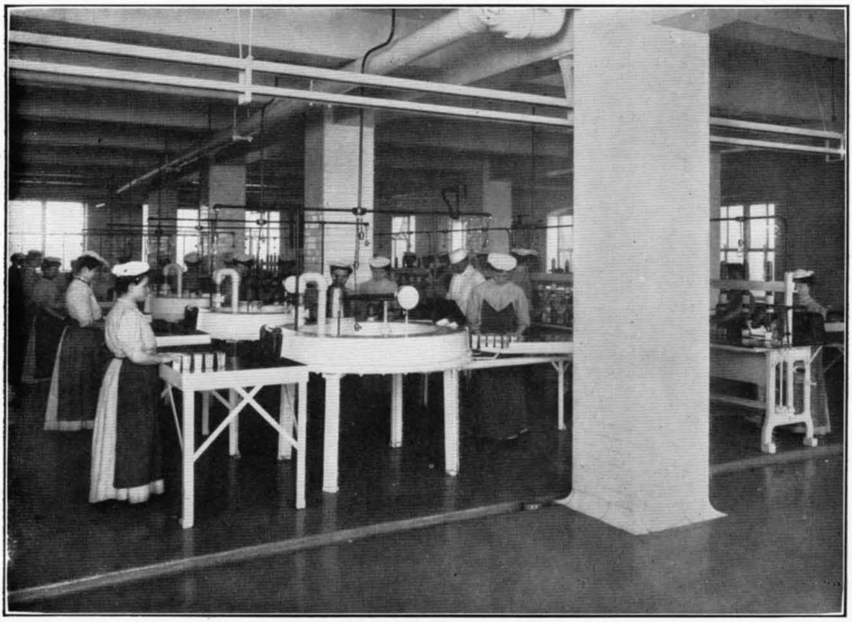

FIG. 2.—SEALING CANS IN VACUUM.

has been greatly lowered through the introduction of labor-saving machinery; consequently canned goods have now come into general use and the industry has become one of great economic importance.

In the canning of meats the great variety in the products prepared necessitates considerable variation in the methods employed, each product requiring a somewhat different treatment. The different packing establishments also have different methods of handling the same product, each establishment being inclined to view its own methods as somewhat better than those of other houses. It is impossible, therefore, to give a detailed description of the various methods employed, and in this article only a general description of the more important processes will be given.

PREPARATION OF THE PRODUCT PRIOR TO CANNING.

In the case of meats which are "processed" or heated in the can, it is customary to subject the meat to a preliminary cooking or parboiling before placing it in the cans. This is done in order to partly cook and at the same time to shrink the product.

The cooking is carried on in large iron tanks, fitted with iron tops, usually hinged, which may be raised or lowered. Sufficient water is used to cover the meat, and the water is heated by means of perforated steam coils in the bottom of the tank. A view of a cook room with tanks is shown in Plate XXXIV, figure 1.

When the meat has been sufficiently cooked it is removed from the boiling water by means of large metal forks and transferred to the "trimming bench," where the gristle, surplus fat, and bone are trimmed off. The meat then goes to the cutting machine, which cuts it into pieces, according to the size of the cans to be filled. After it is cut to the proper size the meat is passed down through a chute to a lower floor, to be packed in the cans. In Plate XXXIV, figure 2, the preparation of corned beef is shown.

In this connection it is interesting to note that gravity is utilized as much as possible in handling the meats. Thus the cooking is usually done at the top of the building, and the meat is then passed down through metal chutes from floor to floor, being subjected to the various manipulations of the canning process on its downward journey.

FILLING AND CAPPING THE CANS.

In the case of products like tongue and Vienna style sausage, where the form of the product is to be preserved, it is necessary to fill or "stuff" the cans by hand. In Plate XXXV, figure 1, the preparation of pigs' tongues is shown.

As will be seen from the illustrations, the work in the canning rooms is largely done by girls, who become wonderfully quick and adept in the work. The girls are furnished by the establishments with clean, washable uniforms, and present a very neat and tidy appearance. Most of the larger plants also employ manicurists to care for the girls' hands and see that they are kept clean.

In the case of corned beef and potted or deviled meat the cans are filled by machinery. The stuffing machines, which usually work on the rotary principle, consist of a series of pistons and cylinders. The cans are placed beneath the cylinders, and the meat is fed into the cylinders from above and is forced down into the cans by the pistons. In Plate XXXV, figure 2, one of these machines is shown in operation. The meat is fed into the stuffing machine with scoops in which the proper amount of meat for each is weighed approximately. When the can leaves the stuffing machine it is weighed and adjusted to the proper weight by adding to or taking out a little of the meat.

After the can has been weighed and the necessary adjustment made in the weight, the top is wiped and any projecting particles of meat are shoved down into the can so as not to interfere with the cap. The cap is next put in place and soldered under a rotary soldering machine. The process of capping the cans is shown in Plate XXXVI, figure 1. The capping machines consist of a series of small revolving tables upon which the cans are placed with the tops laid loosely in position. The caps are then clamped down from above and are soldered either by hand or by automatic soldering irons. When the cans leave the capping machine they have been completely sealed except for the small ventholes in the top, through which the air within the cans is to be later exhausted.

The cans are next inspected for cap leaks (i. e., leaks in the solder holding the cap), and these are repaired by hand.

SEALING THE CANS UNDER VACUUM.

The next step in the canning process consists in exhausting the air from the interior of the can, and this is usually effected by means of vacuum machines. The usual form of vacuum machine is shown in Plate XXXVI, figure 2, and consists of a large circular iron box with air-tight doors and a small glass window through which the vents are sealed by means of an electric soldering iron. The machine is filled with cans and closed, the vacuum is then applied, and the vents are sealed as the cans are brought beneath the window on the movable bottom of the machine.

From the vacuum machine the cans are run out on tables and again inspected for leaks. Any leaks that are found are at once repaired by hand, the vents of these cans are then reopened, the cans replaced in the vacuum machine, and the vents resealed under vacuum. The cans are now ready to be processed.

PROCESSING THE CANS.

Processing consists in heating the cans to a sufficiently high temperature to insure the preservation of their contents, and constitutes one of the most important steps in the whole canning process. Two general methods of processing are followed, known as the "retort process" and the "water process."

In the retort method of processing the cans are placed in large iron or steel boilers, known as retorts, which can be securely closed by means of bolts. In these retorts the cans are subjected to the action of steam under pressure, and in this way high temperatures can be secured. The length of time the cans remain in the retorts and the temperatures employed depend upon the nature of the product and the size of the cans.

In the water method of processing the cans are placed in large open kettles or tanks filled with water, which is raised to and maintained at the boiling temperature by means of steam pipes. The cans remain in the boiling water for varying lengths of time, depending upon the size of the can and the nature of the product.

SPRAYING AND WASHING.

After they have been processed the cans are placed under a cold spray and allowed to remain until thoroughly chilled. When they leave the retorts or kettles in which they are heated the ends of the cans are bulged outward, owing to the expansion of the contents by the heat to which they have been subjected, but after they are chilled the ends of the cans draw in and present a slightly concaved appearance. The cans are now subjected to another inspection, and any that are defective or leaky may be readily detected, as in these cans the ends remain bulged after chilling.

The cans are next passed through a washing machine, which consists of a long iron tank fitted with a movable carrier, by means of which the cans are slowly passed through a hot solution of caustic soda. This is done to remove any fat or grease that may adhere to the cans and is necessary in order that the cans may be subsequently painted. After passing through the soda solution the cans are washed with hot water in order to remove the alkali.

The cans are now ready for painting and labeling, but before being transferred to the paint and label rooms they undergo another inspection at the hands of experts, who feel and tap each can. All cans which emit a hollow sound when tapped are cast aside.

PAINTING, LABELING, AND PACKING.

Painting and labeling constitute the finishing touches whereby the cans are transformed into the attractive packages which we see on the shelves of the grocery stores. The painting is done by hand, as no satisfactory machine has yet been devised for applying the paint to the cans. The cans are painted on long, slat-topped tables, upon which they are stacked in great piles with spaces between the cans to allow for drying. Beneath the tables are steam pipes to hasten the drying. The girls who paint the cans are quite expert in detecting leaky cans, so that the cans really get another inspection at this time.

The cans remain in the paint rooms, as a rule, for several days at a temperature favorable to the growth of bacteria, and this gives an opportunity for the development of what are known as "slow leakers." A slow-leaking can is one that contains a small leak, through which the air gains entrance to the interior of the can. In time such cans become "swellers," owing to the development within the cans of bacteria, which set up putrefactive changes, resulting in the formation of gases, which cause the cans to swell. A swelled can is one in which the ends are bulged outward, and such cans give a hollow or drumlike sound when struck.

After they have been painted the cans are ready for labeling, and this, like the painting, is mostly handwork. Machines have been devised for attaching labels to the smaller cans, but do not seem to be altogether satisfactory. The girls who attach the labels become wonderfully adept, however, and the machinelike rapidity with which they work is truly astonishing.

After they have been labeled the cans are usually packed in crates or cases and placed in stock. The men who do the packing, like the girls who do the painting and labeling, are quite expert in detecting leakers, so that the cans thus undergo still another inspection before they are packed. The operations of painting, labeling, wrapping, and packing occupy several days, as a rule, and this gives an opportunity for the development of the slow leakers, which have been described.

GOVERNMENT INSPECTION AND THOROUGHNESS OF THE METHODS EMPLOYED.

The canning of all meats at establishments which conduct interstate or foreign trade is carried on under the supervision of Government meat inspectors, who watch the process from start to finish. The Government inspectors are men who have had years of practical experience in the canning of meats and have at their fingers' ends the details of the various processes employed. These men not only watch the condition and quality of the meats that go into the cans, but are careful to see that the meats are handled in a cleanly and sanitary manner and that the methods of processing are adequate and thorough.

The proper methods of processing the various meat products have been carefully worked out and perfected by the different packing establishments. As a check on their methods of processing, however, most establishments maintain test rooms or hot rooms, which are small rooms fitted with tiers of open-work metal shelves and maintained usually at a temperature of 100° to 110° F. A sample batch of each run of canned goods is placed in the test room and kept there for a week or 10 days, and if at the end of this time the cans show no signs of swelling the packer feels sure that his cans have been properly processed and that they will withstand even the summer temperature of a warm climate.

Occasionally, in spite of the frequent inspections and tests which the cans receive before they leave the canning establishment, a slow leaking can will get out on the market, and if the weather is warm or the can goes to a warm climate it may later develop into a sweller upon the shelf of the retailer. In this case the retailer will usually notice the condition of the can and either return it to the packing establishment from which it came or charge the latter with the loss. It is just as well, however, for the consumer of canned goods to know the difference between a sound can and one that is not sound, and this can be determined even by the layman. If the ends of the can are slightly drawn in or concaved and the can emits a dull sound when struck on the top and bottom, the can may be considered a sound one. When, however, the ends of a can are bulged outward and the can emits a hollow or drumlike sound when struck on the top or bottom such a can should be regarded with suspicion, and if, on making a small puncture in such a can, the sound of escaping gas can be heard, it is proof positive that the contents have undergone putrefactive changes resulting in the formation of gases, and such cans, of course, should be rejected. However, the chief concern in packing establishments is to see that no defective or leaky cans get out on the market, and in view of the frequent inspections which the cans receive in the course of preparation it is safe to say that very rarely does a defective can reach the consumer.

VALUE AND USEFULNESS OF CANNED GOODS.

In the canning of meats under Government inspection no preservatives are used; in fact, they are not necessary, as meats can be readily preserved by the aid of heat alone. As to the value and wholesomeness of canned meats there can be no question. They fill an especially useful rôle in the provisioning of armies and navies, and our great packing establishments claim with a considerable degree of truth that they must be considered an important factor in the conduct of a successful campaign by contending nations. In the Russo-Japanese war the Japanese forces were supplied with canned meats obtained chiefly from the United States. For exploring and camping expeditions, in mining and logging camps, and for field work generally, canned goods are now almost indispensable. Aside from these uses, however, canned goods are being used more and more in the homes of the people, and statistics show that the canning industry has come to fill an important place in the feeding of the race.

THE VALUE OF SNOW SURVEYS AS RELATED TO IRRIGATION PROJECTS.

By Alfred H. Thiessen,
Section Director, Weather Bureau.

INTRODUCTION.

The irrigating farmer asks: "How much water will I have this season?" He is interested in the quantity of water which the mountains will yield to him, no matter what kind of crop he may plant. His interest, of course, is entirely practical. If he knew just how much water he would have for a coming growing season he could tell approximately the value of his crop. The engineer is also interested in this question. If he were to build a dam either for power or irrigating purposes or both, a knowledge of the average amount of water which passes a given point would be of greatest value to him. And after the dam is built this knowledge would also be important.

The greater part of the moisture precipitated as rain or snow is evaporated from the surface of the oceans. After evaporation the water vapor is borne along by the general eastward drift of the atmosphere and precipitated according to the well-known laws of rain and snow formation. Snow is deposited on the lower levels in the winter time, but at the higher elevations the first snow occurs in the early fall and continues all winter and spring. At the very highest levels precipitation is in the form of snow, even during the summer months.

In general, precipitation increases from the lower levels to the 6,000 or 7,000 foot contour, when it diminishes. The average line of perpetual snow, which varies from year to year, depends upon many factors, some of which are elevation, exposure, latitude, depth of snow, and temperature. In Spitzbergen, about at the seventy-seventh parallel, the snow line is 1,500 feet above sea level, while at Quito, near the equator, the snow line is 15,000 feet above sea level.

In Utah the melting of the snow at the lower levels continues all winter, off and on, according to the weather, and generally during March every vestige of snow has disappeared from the plains. By the end of spring the snow cover has retreated up to the 8,000-foot level; and by June to the 10,000-foot level.

If the precipitation in the mountains were known, then some knowledge of the amount of moisture available for irrigation and other purposes would be at our disposal. But owing to the almost total absence of inhabitants at the higher levels, there are no facts upon which the probable water supply may be based. Granting that the falling snow may be measured, then one can know the winter's precipitation, but not the available water supply, because during the winter thaws may occur, causing melting, the amount of which can not be easily estimated. It would seem, then, that the best way to determine the amount of snow that is to furnish water for irrigation is to measure the snow layer in the early spring just before general melting begins. Measuring the depth and density of the snow layer was first done as early as 1905 in connection with river work. In 1910, Mr. J. C. Alter suggested that this method be applied to the measurement of the snow layer in the mountains of Utah for determining the water supply for irrigation and other purposes.

To appreciate the problem of measuring the snow layer, one should go into the mountains, study the topography, and note how the snow lies. The accompanying illustrations (Pls. XXXVII–XLI) show clearly how the snow is disposed in a watershed. One sees at once, as he might have guessed, that the snow does not lie in an even layer over the mountain side, but is blown, not only during a snowstorm, but afterwards, into gullies and ravines, forming immense drifts. And it is to the forming of these drifts that we owe our summer water supply. This snow becomes solidified in many places in the ravines to the density of ice. This great density is due to the great depth of the drifts, the upper layers bearing down upon those underneath and packing them, and to occasional rains and the partial melting of the top layer during the day, when the water seeping through the snow unites the snow particles thoroughly, and this mass is converted into ice during the next freeze.

In the forested area the snow layer is quite even and consequently less packed. Melting therefore occurs more readily, and oftentimes one can see a wooded portion entirely free from snow, while a snow field on a southern exposure will endure well into the summer, due, of course, to its great depth and solidity. Again, some of the snow clings to the branches of the trees, which exposes an immense area to evaporation. This, in turn, diminishes the amount of water yielded by a forested area to irrigation.

THE PROBLEM OF A SNOW SURVEY.

The problem, then, is to find the water equivalent of every patch of snow in a watershed. To do this requires the measuring of the area of every patch above the highest canal or above the dam, and finding the average depth and density.

The United States Weather Bureau undertook to work out this problem in the spring of 1910, when Prof. Willis L. Moore, chief

FIG. 1.—CORONA LAKE, COLORADO, SUPPLIED ALMOST ENTIRELY BY SNOW PACKS FROM UNFORESTED SLOPES.

[Elevation about 12,000 feet. Photograph taken in the latter part of August.]

FIG. 2.—VIEW SHOWING THE WAY SNOW LIES IN THE SIERRA NEVADA MOUNTAINS DURING JULY.

FIG. 1.—VIEW SHOWING HOW THE SNOW LIES AND FEEDS THE LAKES.

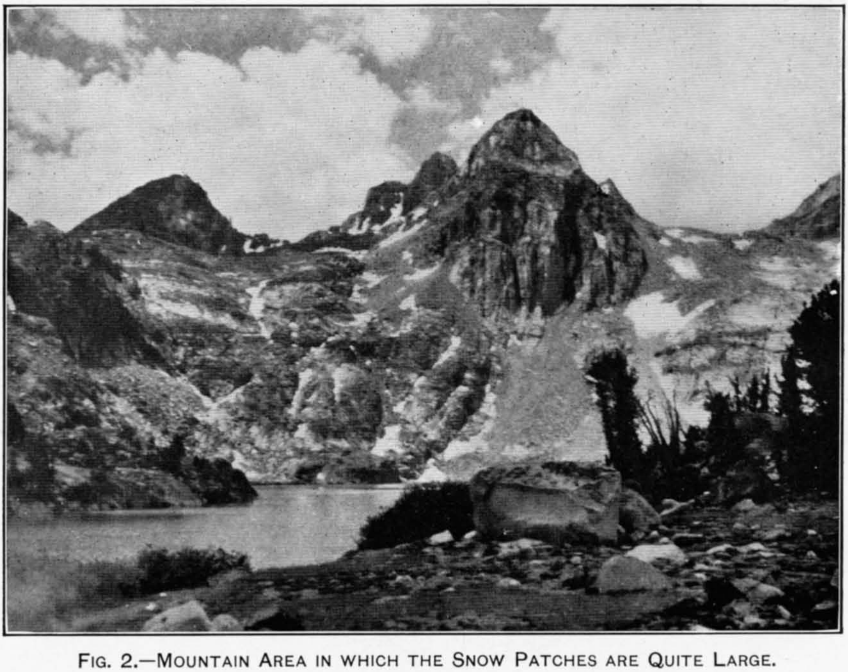

FIG. 2.—MOUNTAIN AREA IN WHICH THE SNOW PATCHES ARE QUITE LARGE.
[Note the almost total absence of trees.]

FIG. 1.—SNOW ON MOUNTAIN PEAKS AT HEAD OF MAPLE AND HOBBLE CREEKS.

FIG. 2.—PORTION OF MAPLE CREEK WATERSHED WHILE SURVEY WAS BEING MADE.

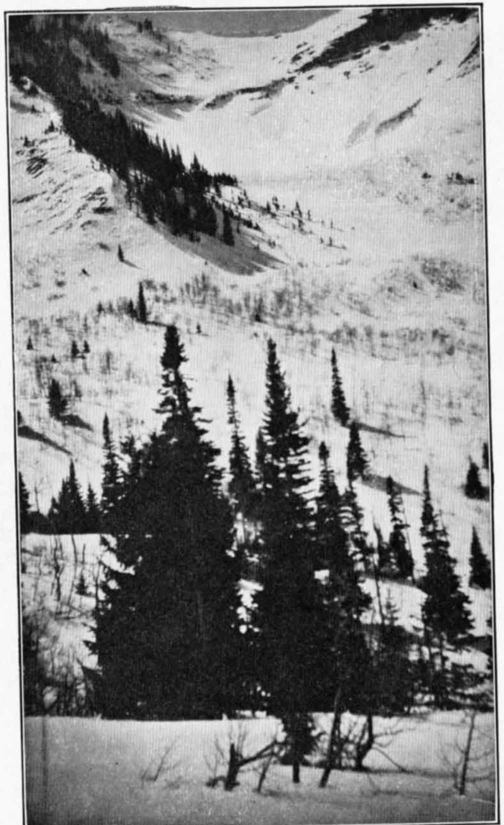

FIG. 1.—VIEW LOOKING INTO THE LAST BRANCH OF RIGHTHAND FORK, NEAR THE HEAD.

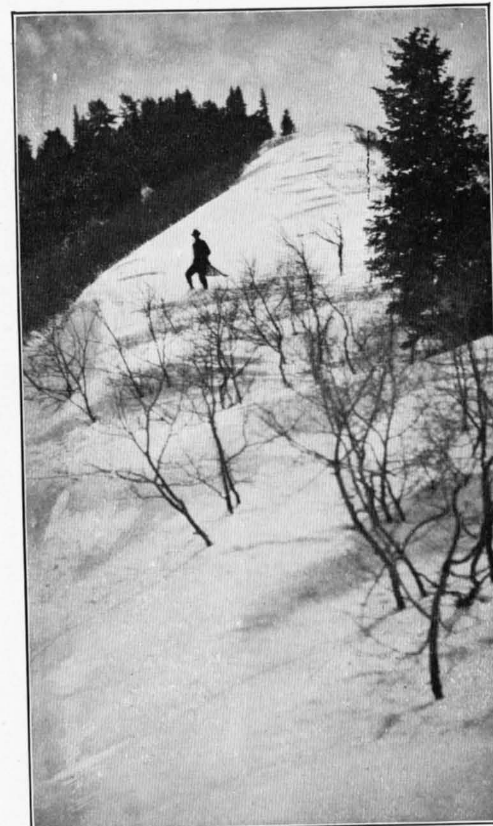

FIG. 2.—THE ONLY DRIFT, A MILE LONG, 50 FEET WIDE, AND ABOUT 25 FEET DEEP.

[Elevation about 8,750 feet, between Dibble and Righthand Fork, looking south.]

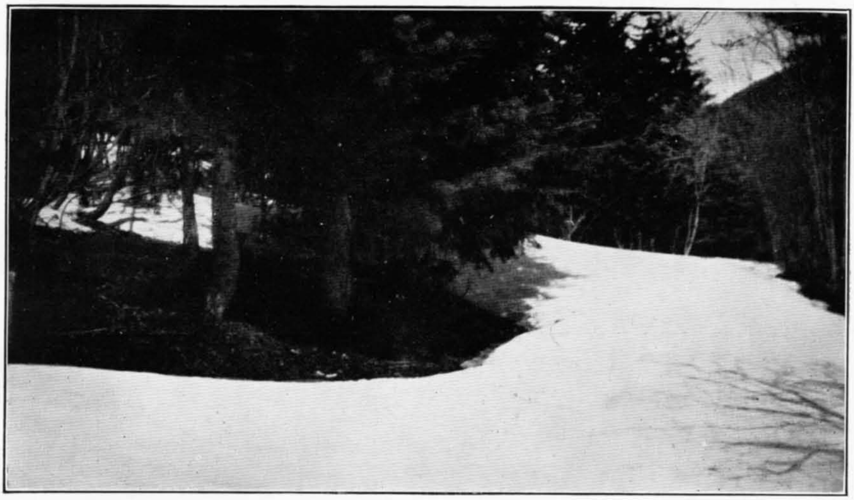

FIG. 1.—VIEW SHOWING THE ABSENCE OF SNOW UNDER TREES.

FIG. 2.—SLOPE GROWN WITH QUAKING ASPS.

[Snow layer very uniform.]

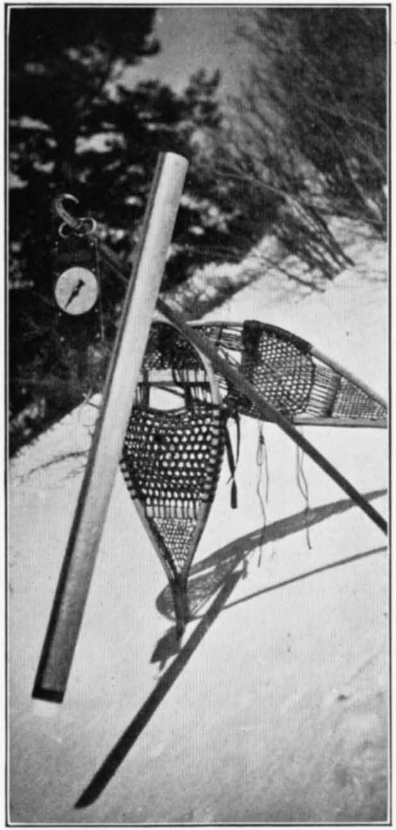

FIG. 1.—APPARATUS USED IN SNOW SURVEY—DENSITY TUBE, ALPENSTOCK, SNOWSHOES, AND SCALES.

FIG. 2.—ON A 40 PER CENT SLOPE, SOFT SNOW.

FIG. 3.—OBSERVER AMONG THE QUAKING ASPS.

of this bureau, authorized the writer to investigate it. Maple Creek watershed (fig. 12) was selected, owing to its freedom from cliffs and to its having fewer natural obstacles than any other canyon within easy distance of Salt Lake City, Utah.

The instruments used consisted of a density tube and scale, an aneroid barometer, a compass, and a metal semicircle with plumb and pointer to secure slope angles. Besides clothing suitable for work of this character, snowshoes and an alpenstock were indispensable. (Pl. XLII.)

The instruments that were used in the spring of 1911 will be changed but little for the survey which will be made in 1912. The density tube worked perfectly, and it is difficult to see how it could be improved. This tube was devised by Prof. C. F. Marvin, of the Weather Bureau. It was made of galvanized sheet iron, $2\frac{3}{4}$ inches in diameter and about 4 feet long. One end of the tube was reinforced by a piece of seamless tubing 6 or 8 inches long and of slightly smaller diameter, which was forced tightly inside the galvanized tube and firmly riveted there. The projecting iron tube was filed to resemble a saw edge to facilitate perforating ice crusts or solidly packed snow.

The outside of the tube was provided with a scale for measuring snow depths. The method of operation consisted in simply plunging this tube into a snow layer and then weighing the tube with its core of snow. The scale on the balance was so arranged that the depth of water, equivalent to the snow layer, was read off at once.

A spring balance was used with the scale modified to give the water equivalent of the snow. The best balance is one made of aluminum and the hand protected so that it can not be broken off when slipped into the pocket.

An alpenstock was found to be most useful. It should have inches graduated upon it and can then be used to ascertain the best place to make a density measurement. The upper end should have an iron hook, so that one can the better climb a slope by hooking on some tree, and also a smaller hook pointed in the opposite direction, so that it may be used for weighing by simply plunging the stick into firm snow and suspending the balance from the smaller hook.

The designing of the apparatus used in work of this kind has much to do with the ease of the work and even the success of the expedition. Where great strength is not desired all metal parts should be made of aluminum. All parts of apparatus should be made to slip into pockets or attachable to clothing by shoulder straps or otherwise.

METHODS.

The distance from the outlet of Maple Creek east and southeast and south to the head of the longest fork was measured with a

250-foot line, and by a complete system of field notes and diagrams all important landmarks were located, including the turns in the canyons and all branches. The direction angles from turn to turn were obtained with a compass. From this general information a map was sketched, showing the main canyon and the outlets of all the branches.

The work thereafter consisted in going up the bottom of each gulch or canyon and back and forth along the slopes, measuring the snow depth and density every thousand feet or so, platting the gulch or canyon on the preliminary sketch more carefully, and mapping the snow areas in the canyons. The snow measurements consisted of numerous soundings of the snow layer with a graduated alpenstock in apparently average places, after which the section of

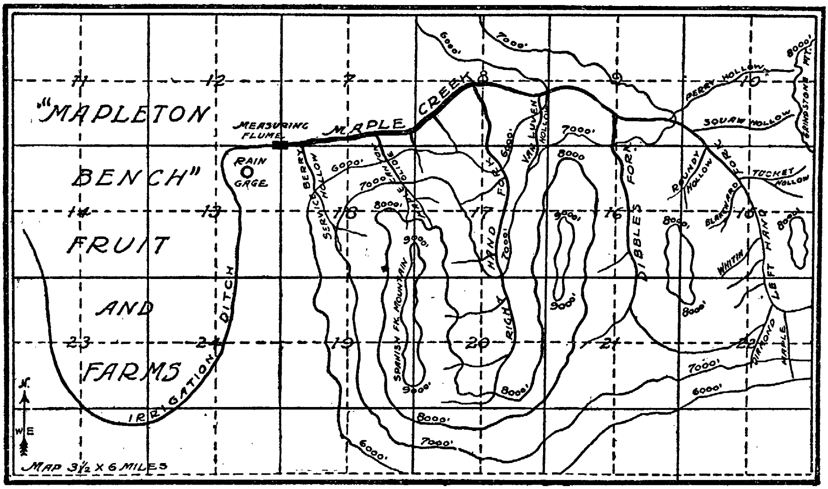

FIG. 12.—Maple Creek watershed, Mapleton, Utah.

snow, estimated as the average, was removed with tube and weighed by suspending the spring-balance scales from the alpenstock thrust into the snow at an angle.

Having all section lines platted on the map, as well as the extent of the snow cover, the total acreage of the watershed was found to be about 6,880 acres, about 4,000 acres being under snow when measured the last decade in March, 1911. About 2,000 soundings were made with the alpenstock, and 277 measurements of the depth and density were made in carefully selected representative places with Prof. C. F. Marvin's density apparatus. This is an average of one density measurement for every 14 acres.

RESULT OF SURVEY.

The average of the 277 depth measurements was 36 inches, and the average water equivalent was 11.5 inches, or 32 per cent, making

3,833 acre-feet of water, or enough to spread 14 inches deep over all the land irrigated under the stream.

VALUE OF THE SNOW SURVEY.

The most apparent value of a snow survey to the irrigating farmer is that with the knowledge acquired he can select his crop more intelligently. The survey should be made, of course, just before planting time.

In general, three cases of water supply may be considered: First, when an average amount may be assured; second, an abundant supply; and third, an amount smaller than the average. If the survey shows that an average amount of water will be the farmer's portion, then he should plant his usual crop. If more than the average amount can be guaranteed, then several plans may be carried out. A crop requiring the usual amount of water may be planted, and surplus water sold to adjacent dry farms; or a crop requiring a great deal of water may be planted, or one that matures late in the season. If less water than usual has been measured, then the farmer must plant a crop requiring but little water; or he may let some of his land lie fallow, or plant a crop that matures early.

Then, again, a knowledge of the amount of water available may save several applications while the crop is maturing. Suppose a farmer knew that his water supply would be short; it would then be wisdom to cut his first crop of lucern early, and thereby secure two good average crops, which would pay better than a very good first crop and a very small second crop.

Further, if a gaging station were established above the highest canal, then, if the two variable factors, seepage and evaporation, could be approximately estimated, the irrigators would know at any time during the season just how much moisture still remained in the watershed. It would serve to indicate how fast the snow in the upper parts of the watershed was melting, and this should be valuable information both to the irrigating farmer and the owners of a dam used for conserving the water for either power or irrigating purposes.

In some canyons engineers wish to build reservoirs either for power purposes, or to conserve the water so that it may be paid out as needed for irrigation, or both. Knowledge of the average, greatest, and least amounts of water passing a given point in a stream would be of highest importance to the engineer and much more important than a knowledge of the amount of precipitation over a watershed, as the seepage and evaporation factors would be eliminated. Snow-survey data, together with stream gagings, would enable the engineer to calculate the most efficient size of dam to build and to predict just how much power he could develop.

A survey of this character is worth much more than the certainty it gives the irrigator regarding the future of his crop or the knowledge as to what crop he should plant. It eliminates his products from that class whose amount of production is more or less problematical. It tends to steady prices and, in addition to the taking away of these uncertain features, gives a crop, although not matured, a money value which it would not have, to such a great measure at least, if the water supply were not known.

The prosperity of every community sways with the successes and failures of the crops. Thus, a snow survey, helping to make the successes more frequent, would be the cause of greater general prosperity.

COTTON IMPROVEMENT ON A COMMUNITY BASIS.

By O. F. Cook,
In Charge of Cotton-Breeding Investigations, Bureau of Plant Industry.

INTRODUCTION.

The American cotton industry presents unusual opportunities for improvement through community organization. Many important advantages are not to be realized by individual farmers working alone, but require the united action of entire cotton-growing communities. Only in this way can improved varieties and other results of scientific investigation be effectively utilized. The present unorganized condition of such communities limits the power of the individual farmer to improve his crop. Organizations of southern corn growers are learning some of the advantages of cooperation in the improvement of a crop, but other and still greater advantages are to be gained with cotton by organized effort on a community basis.

A right choice of methods is as necessary in applying the results of scientific study as in conducting investigations. Methods of improvement well suited to other crops are entirely inadequate with cotton. The crossing of varieties in the field and the mixing of seed in gins render it unusually difficult to preserve the uniformity of superior varieties. Uniformity is more important with cotton than with corn, because the fiber is used for manufacturing purposes. Selection is more difficult with cotton, but has a double value, for uniformity not only increases the yield but adds to the commercial value of cotton.

Two things are necessary for any adequate application of the results of scientific investigation to the cotton industry: (1) The superior varieties that are bred must go into general use and (2) their uniformity must be maintained by continued selection. Experience has shown that neither of these objects is likely to be attained by the miscellaneous distribution of small quantities of seed. Such distribution serves to introduce a variety to the farmer's attention, but this is only the first step toward effective utilization. Unless new varieties are adopted by whole communities instead of by scattered individual farmers there is no prospect that their full value will be realized or that their uniformity will be maintained. These objects would be much easier to secure if each neighborhood or group of farmers who grow their cotton in adjacent fields and carry it to the same gins could act together as communities. The community should agree, if possible, upon the planting of one kind of cotton and take measures for maintaining the purity and uniformity of the stock by continued selection under the local conditions. This would mean larger crops, better fiber, and higher prices, not only because of the improved quality but because each community would be able to produce a commercial quantity, a hundred bales or upward, of the same uniform type of cotton.

Cotton growers have been urged to organize in order to reduce production or to secure higher prices by withholding the crop from the market, but there are other and more positive objects to be gained. An occasional period of low prices is not as serious a danger to the cotton industry of the United States as continued high prices that stimulate a rapid development of cotton culture in other countries. A well-established foreign competition means an ultimate reduction or restriction of prices. The United States has no natural monopoly of production, for cotton can be grown in many other parts of the world. Active efforts to develop the culture of cotton are now being made in numerous foreign countries, particularly in Mexico, Peru, Brazil, Argentina, Algeria, Sudan, Togoland, Nigeria, India, Turkestan, and China. The only adequate protection against foreign competition is to improve our own industry by growing better cotton and by growing it more cheaply than other countries are able to do, notwithstanding the lower wages of their farm labor.

The organization of cotton-growing communities to study and remove the present obstacles to progress would place the American cotton industry on a much firmer basis in relation to foreign competition. Many communities have public-spirited citizens willing to undertake measures of agricultural improvement. A statement of the problems of the cotton industry that can be solved by community effort will serve a useful purpose if it enables such activities to be directed to better advantage. In some localities there are organizations already in existence that may be able to undertake the work. In view of the wide differences of local conditions it is not to be expected that all organizations of cotton growers will take the same form or attempt the same things.

WHY KNOWLEDGE OF COTTON HAS DECLINED.

Community organizations are especially needed with cotton because of the peculiar nature and uses of the product. Notwithstanding the unique commercial importance of the cotton industry the farming public has less knowledge of cotton than of most branches of agriculture. Unlike the other principal crops, cotton is not raised for food or forage purposes, but is a purely industrial or commercial product. A food crop remains as part of the life of the agricultural community where it is grown and used, only the surplus passing into the general channels of commerce. In former times, when the weaving of cloth and the making of garments were domestic arts, both producers and consumers were more familiar with cotton and more able to appreciate the quality of the fiber. But cotton is no longer put to any domestic use by the farmer or his family. It is raised only to be sold and shipped away.

Improvements in textile machinery and the factory system of labor have led in the last half century to an enormous expansion in the production and use of cotton, but there has been no corresponding improvement in the quality or intrinsic value of the fiber or in the methods of growing and marketing the crop. The industrial superiority of cotton is usually supposed to lie merely in its cheapness, but cotton of good quality can compete with any other fiber in strength, fineness, and durability. Though the consumption of cotton has vastly outgrown that of any other textile material, the true possibilities of the fiber are still very inadequately appreciated.

The popular idea of a generation ago that fine fabrics were stronger and more durable than coarse fabrics was based on mechanical limitations which inventors have now overcome. With improved textile machinery many lines of goods that formerly required strong long-staple cotton can now be made from much shorter and weaker fiber. The decline in the wearing qualities of cotton fabrics is often ascribed in cities to the use of destructive chemicals in public laundries, but the same deterioration is recognized in the country, where household washing is still practiced.

Some manufacturers are frank enough to say that they do not want long or strong cotton, thus encouraging farmers to plant inferior varieties. If the goods wear out faster new garments must be purchased more frequently and this brings larger profits for manufacturers of weak fabrics. Such disregard of the interests of the consumer may gain temporary profits, but it can not be expected to establish the industry on a basis of permanent prosperity. The public is at last beginning to appreciate the different values of strong and weak cotton. Manufacturers of long-staple goods have undertaken an active compaign of education regarding the superiority of their fabrics. Some of the States have laws forbidding the adulteration and misbranding of textile articles. The need of pure-clothes laws is the same as for pure-food laws, for the rapid wearing out of weak cotton not only results in enormous financial loss to the public, but represents a general danger to health. Broken cotton fibers form a large part of the household dust that is now recognized as a serious factor in the development of tuberculosis.

That cotton is so purely a commercial crop and that popular knowledge and interest in cotton tend to decline rather than to increase under the present conditions show that community organizations of cotton growers are needed for educational purposes, if for no other reason. More must be known about cotton, not only among farmers who produce it but also among manufacturers and ultimate consumers, before any general improvement of the industry is to be expected. The loss to consumers is greater in the aggregate, no doubt, than the loss to the producers, but the farmers are more acutely interested and the active work of education should begin with them.

INADEQUATE PRODUCTION OF HIGH-GRADE COTTON.

The need of a better system of production on a community basis is most conclusively shown by the fact that the present supply of strong high-grade cotton is entirely inadequate. The general use of weak, short-lived fiber represents an enormous industrial waste that would not be tolerated if it were understood that stronger and more durable cotton could be obtained in sufficient quantities. All high-priced articles are supposed to be made of Sea Island cotton, but this fiber is grown only in limited areas. There has been no extension of the production of the Sea Island cotton to correspond to the new industrial requirements.

The increasing importation of Egyptian cotton by American manufacturers also shows that the production of high-grade fiber in the United States has not been keeping pace with the existing demand, to say nothing of providing for the future expansion of the industry. The spread of the boll weevil has greatly diminished the production of long-staple Upland cotton in Louisiana and Mississippi, and at the same time the Egyptian crop is threatened by a serious reduction in yield as well as a deterioration in quality. Earlier varieties of Upland long-staple cotton have been developed to replace the late varieties that are being driven out of cultivation by the boll weevil. Other new varieties have been acclimatized in regions where long-staple cotton is not now grown. But these new lines of production are likely to have only a very slow and gradual development unless they can be fostered through community organization.

The most acute need of long-staple cotton is for automobile tires, high-pressure hose, mail bags, and other articles where strength of fiber is a paramount consideration to secure additional safety for life and property. If the industrial world appreciated the possibility of securing still stronger fabrics from special types of cotton, manufacturers would soon find it to their interest to obtain supplies of the strongest cotton that can be grown. The cost of the raw material is a relatively small factor in the selling price of high-grade articles.

The manufacturer may save a dollar by making an automobile tire out of short-staple cotton and low-grade rubber, but the purchaser loses much more than the manufacturer gains, to say nothing of increased danger and annoyance. Manufacturers of high-grade textiles are prepared to pay advanced prices for superior cotton if regular supplies can be assured.

Communities that have natural conditions of climate and soil suited for producing long-staple cottons should study and prepare to take advantage of the existing and prospective demands for superior fiber. Though not every community can produce long-staple cotton, there are very few communities that can not grow a longer and more uniform staple than they are now producing. There are probably hundreds of communities in every State of the cotton belt where the conditions are favorable enough to produce cotton worth from 1 to 5 cents a pound more than the present miscellaneous crop. The individual farmer can not be assured of any such advantage from the production of a few bales of good cotton, but a united community would be able to obtain the advanced price in proportion to the improvement of the crop.

EXTENDING THE PRODUCTION OF LONG-STAPLE COTTON.

The organization of communities of growers is the best way to extend the production of cotton into new regions. The possibilities of producing long-staple cottons in different parts of the United States are only beginning to be realized. But even under the most favorable natural conditions the farmer will not begin to grow cotton unless ginning facilities and local markets can be provided. New weevil-resistant types of long-staple Upland cotton have been introduced from Central America and Mexico and acclimatized in Texas. They are as well adapted to the arid regions of the Southwest as ordinary short-staple varieties and yet are able to produce fiber of good long-staple quality under favorable conditions. A small amount of irrigation water can be used to better advantage in raising long-staple cotton than with any other crop now grown in the irrigated districts of the Southwest.

The production of Egyptian cotton in the irrigated districts of Arizona and southern California is another undeveloped branch of the cotton industry. After several years of acclimatization and breeding, superior strains have been developed. Excellent crops have been raised and the fiber has brought prices in advance of imported Egyptian cotton.

The advantages of community organization may be secured more easily in regions where cotton culture is only beginning, as in southern and western Texas and in the Imperial Valley of southern California. Organizations of cotton growers have already been formed in some of these far western communities. Where cotton is an old and well-known crop farmers have settled habits which they are unwilling to change. But with the advance of the boll weevil many new methods are being adopted, and these readjustments make it easier to introduce the improvements that can be secured by community organization.

COMMERCIAL SELECTION COMPARED WITH AGRICULTURAL SELECTION.

If the skill and discrimination now used in buying and selling cotton could be applied to raising it, the product would be greatly improved. Community organization would aid in bringing this about by enabling the farmer to acquire special knowledge like that used by the buyer in separating and grading the different kinds of cotton. The present system of handling the crop interferes with the improvement of the cotton industry in two ways—it tends to the production of inferior cotton and to the payment of inadequate prices for superior cotton.

Agricultural selection, or discrimination between plants in the field, is absolutely necessary as a means of securing good seed and preserving the uniformity of superior varieties. But instead of agricultural selection, or the judging of the cotton on the farm, the present system provides only commercial selection performed by the buyers in the warehouses after the cotton has passed out of the hands of the farmer. The bales that contain superior cotton are separated, assembled with others of similar quality, and sold to the manufacturers at higher prices. It is not to be expected that buyers should undertake to educate farmers regarding the true value of their cotton and pay them more for it than necessary. The business of the buyers is to buy cotton cheap and sell it dear. To a breeder's question whether he would pay a premium for a certain variety of cotton, a buyer replied "Yes; if I had to." In one instance four bales that local buyers would take only as middling cotton, then worth about 9 cents, were sent by the planter to New Orleans and sold at 19½ cents, more than double the highest local offer.

The individual farmer is seldom able to deal directly with the manufacturer, because he seldom has what the manufacturer wants—a commercial quantity of one kind of cotton, for making a particular line of goods. Manufacturers have no use for miscellaneous small lots of cotton like those produced in unorganized communities where each farmer is likely to plant a different variety and follow a different method of culture. The commercial selection and assembling of commercial quantities of the different grades and qualities of cotton, as carried out by the buyers, is a necessary part of the present system and is to be avoided only in communities that devote themselves to the production of a uniform type of cotton.

The cost of the present system of commercial selection, represented by the profits of the buyers, falls chiefly on the farmers who produce better cotton than their neighbors, but are unable to secure a corresponding advance in price. Many dealers refuse to consider the essential qualities of length and strength of fiber in buying the cotton from the farmer. As one farmer put it, "They used to draw the staple, but now they only shake it over a paper." A farmer who takes the trouble to raise a crop of superior fiber and is then refused a premium can hardly be expected to repeat the effort. He is more likely to apply to the Department of Agriculture for a variety that will produce the most pounds of lint without regard to quality. At the same time come requests from manufacturers that the planting of long-staple cotton be more actively fostered. These conflicting demands show that the present system is not advancing the true interests of either the producer or the manufacturer, to say nothing of the ultimate consumer.

CONTACTS BETWEEN PRODUCERS AND MANUFACTURERS.

Manufacturers who use long-staple cotton are anxious, of course, to increase the production of superior fiber. Though willing to coöperate in the improvement of the industry, they have not realized the practical advantages of closer contact with the growers. In reality the present system of commercial selection is far from the best that could be devised for the manufacturer's purpose. The true quality and uniformity of a crop of cotton can be determined much more reliably by field inspection than by the pulling of samples from bales, even by the most skillful of commercial graders. Opinions of commercial experts, based on samples of the same lot of cotton, often show serious disagreement and wide departure from the actual facts. Manufacturers could effectively protect their own interests and at the same time stimulate the production of high-grade cotton by purchasing their supplies on a basis of field inspection. Selection and other precautions would soon receive the attention they deserve, for farmers would be assured of the higher prices that the manufacturers could well afford to pay for uniform cotton.

The individual farmer with only a few bales of superior cotton to offer is usually under the necessity of taking what the local buyer will give, but a community or association of farmers producing a commercial quantity of one kind of cotton would be able to secure much better consideration from buyers or could place themselves in direct communication with manufacturers. Perishable fruits and truck crops are now being marketed successfully by hundreds of cooperative associations of growers in different parts of the country, and there is no apparent reason why communities organized for the production of high-grade cotton should not be able to sell their own crop to the manufacturers.

PRESERVING THE UNIFORMITY OF VARIETIES.

The fundamental agricultural advantage to be gained by community organization is the production of uniform crops of cotton. The cotton industry will show little improvement from the breeding and distribution of superior varieties until better provision is made for preserving the uniformity of select strains. Superior varieties are of practical value only to the extent that they are preserved and utilized for purposes of production. No matter how desirable in other respects, a variety of cotton can not be considered superior unless it is kept uniform, nor can any variety be expected to remain uniform unless selection be continued and admixture with other varieties be prevented.

The work of maintaining uniformity by selection is very simple, though natural ability, training, and practice are necessary to develop the power of recognizing minute differences that the casual observer would entirely overlook. The first essential, of course, is thorough familiarity with the superior type that is to be maintained, so that all variations may be detected and removed.

That varieties soon "run out" when selection is relaxed is a well-known fact, but it is not so generally understood that the running out of a superior variety is merely a loss of uniformity; in other words, a return to the condition of diversity found in unselected stocks. Even in the most carefully selected strains inferior and abnormal individuals appear, and if these are allowed to ripen seed or even to cross-fertilize other plants with their pollen a loss of uniformity is sure to result. Improved methods of selection have been developed which make it possible to distinguish degenerate plants early in the season. Indeed, it is usually easier to recognize and remove them at that time than after the crop has matured and the bolls are open.[1]

Uniformity has a commercial value in cotton because of the industrial uses of the fiber. Threads of even strength and fineness can not be spun from irregular staple. The spinning machines must have fibers of nearly equal length in order to work smoothly. Special machines have been invented to comb out the fibers and separate the long from the short, but each operation increases the cost of manufacture. Neglect of selection in the field has to be made good by expensive mechanical processes.

[1] Cotton Selection on the Farm by the Characters of the Stalks, Leaves, and Bolls. Circular 66, Bureau of Plant Industry, U. S. Dept. of Agriculture. 1910.

Loss of uniformity in the plants means reduced yield as well as inferior fiber, for many of the plants that depart from the characters of the variety are degenerate and produce very little cotton. Experiments indicate that a general application of selection would increase the yield by at least 10 per cent and would enhance the quality and value of the fiber to an even greater extent. A general adoption of improved varieties and methods of selection and cultivation would bring an enormous increase in the value of the American cotton crop. As an estimate of the advantage to be gained annually $200,000,000 is not unreasonable.

The requirement of uniformity in long-staple cotton makes community organization especially necessary in long-staple districts. The crossing with short cotton in the field or the mixture of seed at the gin leads to a rapid deterioration, even before the stock of seed is increased to the scale of commercial production. The distribution of long-staple seed in short-staple communities also involves the danger of having the two kinds of cotton combined into mixed bales, which are often refused in the market. In short, the only practical way to distribute and extend the cultivation of superior varieties of cotton is by districts or communities. The work of breeding and acclimatization of new types of cotton is largely in vain if they are to be utilized only for miscellaneous distribution.

RELATION OF GINNING FACILITIES TO PRESERVATION OF VARIETIES.

In an organized community devoted to the culture and improvement of one type of cotton, conditions would be much more favorable for preserving the uniformity of select strains. With only one kind of cotton in the neighborhood there would be no danger of crossing with other varieties in the field or mixing seed at the gin. Every farmer who intends to plant his own seed or sell seed for planting should see that his cotton is ginned without being mixed with other stocks of seed.

The importance of the separate ginning of different kinds of cotton is already recognized in some localities. A few progressive ginners have installed small machines for ginning cotton from select fields and seed plats apart from the general crop. Such facilities are needed in every community as a means of encouraging the more careful selection of cotton seed. The extra equipment would not be very expensive, and many ginners would be willing enough to provide it as soon as it became a means of attracting or holding the patronage of the more intelligent part of the community.

The most difficult task of ginning falls to the breeder who uses the most careful system of selection, i. e., by means of progeny rows planted from the seed of superior individual plants. Some breeders gin their individual samples by hand, while others plant the seed without ginning. Manufacturers are beginning to make small gins for work of this kind. Organizations of cotton growers could well afford to provide for the ginning of small samples of seed as a means of encouraging local breeders and thus maintaining a supply of high-grade seed for the community. The small machines could be located at a central point where power is available, or hand-power machines could be circulated among the members of the community who wished to grow separate progenies of individual plants.

COMMUNITIES SHOULD GROW THEIR OWN SEED.

It is in the interest of communities to grow their own seed, for better crops can generally be secured from properly selected home-grown seed. A variety of cotton that has been rendered very uniform by selection in one locality may show many variations when transferred to other conditions. If these variations are recognized and removed, the stock behaves in a more uniform manner in later generations. Experiments have shown distinctly higher yields for locally selected stocks in comparison with adjacent rows planted with the original parent stock, a part of the original seed being held over for the purpose of making the experiment.[1]

In view of these facts it is evident that local breeders can do better work for their home community than breeders in other parts of the country. The work of selection is more effective if done under the same conditions where the crop is to be grown. Farmers who wish to buy their cotton seed instead of selecting it for themselves should give preference to seed raised in their own communities.

The farmer who buys his seed in his own neighborhood has the chance of inspecting the fields so as to form his own judgment regarding the skill and carefulness of the grower and see with his own eyes whether the stock represents a uniform and otherwise desirable type for his own cultivation. No such inspection is possible if the seed is ordered from a commercial dealer in a distant city. In reality, much of the seed sold for planting is raised without any adequate precautions against crossing with other varieties in the field or mixing seed in the gin.

If organizations grow up in the cotton industry like the clubs and associations of breeders that are proving so important a factor in the improvement of corn, it will be still more important with cotton than with corn to have the factor of uniformity taken into account in contests and awards of prizes. If, for example, a contest of local breeders is to be held, with prizes for the best strain

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[1] Local Adjustment of Cotton Varieties. Bulletin 159, Bureau of Plant Industry, U. S. Dept. of Agriculture. 1909.

of a local variety of cotton, the most important exhibit should consist of experimental plats representing the different strains. The superiority of the stocks from the standpoint of breeding should be determined by their freedom from variations. It is possible to judge this factor even in the widely separated fields. Indeed, it is much easier to compare the uniformity of different stocks than it is to determine their productiveness. The cotton plant is extremely susceptible to the influence of even very slight differences of external conditions. Rows planted from the same stock of seed, at the same time, in apparently uniform soil, and cultivated in the same way often show differences of from 10 to 20 per cent in the yield.

COOPERATIVE STUDY OF CULTURAL PROBLEMS.

In addition to gaining familiarity with improved varieties and methods of selection many other improvements could well be studied by organizations of cotton growers. Cultural methods that appeared satisfactory before the arrival of the boll weevil have become entirely inadequate for the production of crops in the presence of that destructive insect. Local conditions of soil, climate, labor supply, and relation to other crops differ so much that each locality is likely to require a cultural system of its own if the best results are to be secured. A cooperative study of cultural problems by cotton growers' associations would be a factor in local progress, for the community would profit more promptly by the efforts of those who have the taste, ability, and judgment to experiment with different methods and draw correct conclusions.

To increase the profits of farm operations by giving more careful or scientific attention to the underlying factors is only one of the advantages to be gained. Approached in the right way, the knowledge and training to be gained in connection with the selection and cultivation of plants are of the very highest educational value in relation to other questions of human life and progress. Many farmers do not live in the country with the idea that they can make more money than in the city, but because they prefer to live and raise their children under farm conditions. They find richer materials of life on the farm than in the town. While cultivating and harvesting the crop the farmer can educate himself to detect variations in the plants. Selection develops powers of observation and appreciation of underlying principles.

In attempting to answer the philosopher's question "What knowledge is of most worth?" it is surely unwise to leave out of account the fundamental biological facts that govern the existence of all living creatures. The time will doubtless come when the effects of breeding and the influence of external conditions upon development will find a recognized place in the teaching of every school and pulpit.

"Thou shalt not sow thy field with mingled seed" is an ancient agricultural law not yet adequately understood or properly obeyed.

ADVANTAGE OF SIMULTANEOUS PLANTING.

The better organization of cotton-growing communities would result in increased protection from the boll weevil. One measure of protection that has been persistently urged upon cotton growers is early planting. When late plantings are made by the side of early plantings very striking differences may be shown. The early cotton may set a crop, but may also breed so many weevils that no bolls can be developed on the late cotton. Though the farmer who plants his cotton earlier is likely to secure an advantage over his neighbor, it is easy to carry the policy of early planting to unpractical extremes. Very early plantings are often killed by frost or have their growth so badly checked that they recover very slowly or remain permanently stunted. A later planting, with more continuously favorable conditions, may outgrow an earlier planting and ripen an earlier crop.

The losses that come from planting too early, as well as the injury done by weevils bred on very early cotton, could be avoided if the time of planting were regulated in the interest of the community. Inequalities of seasons and local conditions would make it undesirable to fix any general date of planting for whole States or even for counties, but a distinct advantage would be gained if local organizations of cotton growers could agree upon a date when planting should begin. With the importance of simultaneous planting once recognized in a community and a local organization to consider and agree upon a date very few farmers would be inclined to disregard public opinion or to incur extra danger for their crop by planting too early.

Planting too late would carry its own penalty and risk to the individual and would not injure the community unless it were allowed to interfere with the early destruction of the stalks in the fall. The advantage of clearing the plants out of the fields at the end of the picking season depends very largely on the time when the work is done and is another measure of precaution that could be applied much more effectively through organizations of cotton growers. The longer the weevils can be left in the fall without food or facilities for breeding, the smaller will be the number to hibernate and survive the winter.

UTILIZATION OF PICKING MACHINERY.

The mechanical picking of cotton is now considered a possibility of the near future. Even though none of the existing machines proves to be entirely satisfactory the progress already made is an assurance of further improvement and ultimate solution of this difficult problem. In view of the necessary complexity and cost of such machines they are likely to be utilized at first in communities where cooperative organizations exist. The cost of operating and repairing can be kept down if the machines needed in a community are handled by a corps of trained and experienced men instead of by the individual farmer, who usually lacks the necessary mechanical skill and equipment

COOPERATIVE FACILITIES FOR HANDLING IMPROVED COTTONS.

As soon as a community undertakes to improve the quality of its cotton the question of improved ginning facilities calls for consideration. It is useless for the individual farmer to begin to raise long-staple cotton unless proper ginning facilities can be provided. The difficulty is more easily met on large estates that have their own gins, but in ordinary communities some form of cooperation must furnish the necessary facilities. In a well-organized community either the manufacturers who require the long-staple cottons, or the makers of ginning machinery, or the organized farmers themselves would find it worth while to install the most improved ginning machinery and handle the crop in a way to secure the highest price in the market. It is claimed that the value of the cotton to the manufacturers can often be increased a cent or more a pound by the roller gins, because the long fiber is turned out in a condition better adapted to manufacturing purposes.

A considerable factor of the commercial superiority of the Egyptian cotton lies in the cleaner and more uniform condition of the commercial product. It is the universal custom in Egypt for the ginning establishments to buy the seed cotton from the farmers and to grade and sort it before ginning, so that bales of uniform quality are secured. Though the superiority of the roller gins and improved baling machinery, at least for long-staple cottons, has been recognized for many years past, the American cotton industry is still to gain any general advantage from these inventions.

Well-conducted ginning establishments would be able to sell their cotton on the basis of recognized marks or brands instead of through the present wasteful system of sampling the bales. They could also furnish the community with the highest grade of seed from the most uniform fields of the preceding season. There is no fundamental reason why cooperative ginneries, compresses, and oil mills should not be conducted for the advantage of agricultural communities in the same way as creameries, canneries, packing houses, and other cooperative enterprises.

CONCLUSIONS.

Producers of many crops have found it to their interest to form local associations, but it is doubtful whether any other branch of agriculture has so many advantages to gain from community organization as the cotton industry. Natural conditions are favorable for a greatly increased production of high-grade long-staple cottons in the United States, but the present system of growing and marketing the crop favors the production of low-grade cotton.

Without the advantages of community cooperation many of the results of the scientific investigation of breeding and cultural problems can not be applied effectively to the improvement of the cotton industry. Unless commercial quantities of the same kind of cotton are produced it is difficult to secure an adequate return for the work of selection required to preserve the uniformity of superior varieties.

In order to maintain uniformity and produce commercial quantities of one kind of cotton communities should limit themselves to the cultivation and selection of a single superior variety. The choice of the variety to be grown, the production of good seed, the determination of the date of planting and the methods of cultivation, the harvesting, ginning, storing, and marketing of the crop are all problems that can be solved to much better advantage by community cooperation than by individual planters working alone.

PLANT INTRODUCTION FOR THE PLANT BREEDER.

By David Fairchild,
Agricultural Explorer in Charge of Foreign Seed and Plant Introduction.

INTRODUCTION.

It is now nearly two centuries since the first successful attempt to hybridize plants was made by an English gardener. This seems a long time if measured in the terms of mechanical invention, but when it is remembered that with most plants such a cross as that first one produced can be made only once a year, the accomplishments of plant hybridization appear truly remarkable. A mechanic makes a new machine and tests it at once; a plant breeder makes a new cross, but must wait for the following season, and if his plant is a tree or shrub he must wait for many seasons before he knows whether he has obtained from his cross something worthless or a new hybrid which is an improvement over that which the world already has.

The inventor makes his machine, patents it, or keeps some feature of its manufacture secret, and on the basis of his secret or his patent convinces capital that some kind of a monopoly can be maintained by which the exploitation of the invention can be made profitable. The plant breeder, on the other hand, can not patent his new variety, neither can he keep its origin secret to any material advantage; consequently he must take the risk of growing a stock of his new plant on the ground of his personal conviction that it will be profitable, and then, if he can, he must sell this stock of plants to the public at paying prices. How difficult is his task of making a large amount of money out of a single new plant hybrid becomes apparent when we consider how easily anyone can obtain a few seeds or cuttings by dishonest methods, from these produce the identical plant, and in a few years have a stock of plants of the same kind for sale, and even claim to have himself originated it by crossing. Coupled with this difficulty, which seems to be inherent in the creation of plant hybrids, is a still greater one, that of adequately testing the new variety before putting it on the market. One can therefore see the reason, or at least one of the reasons, why even more has not been done to make new forms of plants which combine old characters or bring into expression new ones.

This difficulty of thoroughly testing a newly originated plant combination explains in a measure why so many of the novelties of our seed catalogues from which seedsmen make their money are disappointing when we come to try them. This is not quite so serious a matter if the plant is an annual, but if it is a long-lived fruit tree that occupies valuable land and requires costly attention, the failure of a variety is often a real tragedy. Only those pioneers in plant breeding who have seen orchards come and go in their regions know the stories of these catastrophes. The writer's first shipment of foreign plants to America was of Corsican citron scions, sent to save an orchard which had been budded with lemons instead of citrons because of the ignorance of the person through whom they had been procured.

Perhaps it is the seriousness of the difficulties surrounding the work of the man who would make his living out of it that has made plant breeding as a profession such a rare thing in this country. And yet the importance of obtaining a single superior variety of plant for the agriculture of a great region often can scarcely be overstated. There is nothing more picturesque in agriculture than the rôle played by the discovery or introduction of a new variety. The vines of the Chautauqua grape belt, producing annually 200,000,000 pounds of grapes, come almost entirely from cuttings of a seedling planted in Concord, Mass., 68 years ago. Both the Elberta and Belle varieties of the peach, which have earned many millions for fruit growers since the fall of 1870, originated in Georgia from the same tree of an imported Chinese cling peach. The founding of miles of orange groves such as the world never saw before is the result of the importation of a single bunch of scions from Bahia, Brazil.

These are familiar examples of discoveries in the agricultural world comparable to the inventions of the telephone and the type-setting machine in the world of technology. And yet Ephraim Bull, who discovered the Concord grape; the Rumph brothers, who originated the Elberta and Belle peaches; and William Saunders, who introduced the Bahia navel orange, received no financial advantage from their discoveries. It must be said that the value of plant breeding heretofore has been very great, but the rewards have been very small.

THE PRACTICAL VALUE OF PLANT BREEDING.

It is because of this really great value to the country in the improvement of its agriculture which plant breeding can accomplish that Federal and State aid to those engaged in it is a legitimate, even a paying investment.

One of the ways in which the Government is aiding the amateur plant breeders of the country is by securing for them the foreign plant species with which to work. These are of such an experimental character and the demand for them is so small that it could not well pay any commercial firm to carry on the correspondence necessary to secure them, much less to send out men who are trained to look for them in those out-of-the-way places where they grow wild.

It is to be regretted that there is still in the minds of many people a feeling that the botanists of the world are more interested in an academic study of wild plants which would be of little practical value than in an attempt to make them useful, for the world is now beginning to "cash in," as it were, on the vast store of knowledge which the collectors and pressers of dried plant material have gathered together with such self-sacrifice and poorly paid service. The systematists have located the wild species of plants and have described them, making it comparatively easy for us to get them whenever they are wanted for breeding purposes. Since Darwin's time this problem of breeding has risen from an unintellectual problem of the farmyard and the flower garden to a point where it attracts the study and attention of the greatest minds. We have come to see in it possibilities of the very greatest moment to the races of men, and an understanding of the laws which govern the variation of plants and animals probably will be one of the great accomplishments of the future, great not only in the effect which it will have on the industry of agriculture but probably as great in its effect on the production of human beings.

NEW ENVIRONMENT A CAUSE OF VARIATION.

Eighty years ago the way in which plants were built up was so imperfectly understood that the cell organ called the nucleus, which has come to play such an important rôle in plant hybridization, had not been discovered; while the presence of a definite mechanism by which the matter that is transmitted from parent to offspring is divided and redivided until every cell in the entire body of the offspring has received a portion of the substance of the parent was not so much as even suspected. It is perhaps the practically universal presence of this cell organ and the uniformity of its mechanism of division that give such importance to any study of it. While it is still a debated matter whether the law of Mendel is supported by the discovery that there are differences in the two halves of the cell nucleus when it divides for the production of the pollen, and while there are those who think the simple numerical coincidence discovered by Mendel is not adequate to warrant the belief in the existence of character unit particles and their alternate transmission in pure germ cells as a general principle of heredity, there is a certain agreement in the experience of plant breeders which has a definite bearing upon the utility of plant introduction. It is upon the basis of these principles that those who are engaged in crossing plants have begun to reach out for more material with which to work in the origination of new and valuable forms.

In the language of recent writers on this subject:

> When germ cells of different varieties are united in conjugation, characters may be brought into expression which neither of the partners would have shown if joined with a mate of its own kind.
>
> Selective narrow breeding renders organisms more and more uniform. One set of characters is repeated in the successive generations of selected stock and the other alternative feature left in abeyance. Uniformity in the expression of one set of characters may increase the agricultural value of the variety, but the restriction of expression to a narrow range of characters results in a weakened vitality and a lessened rate of increase.
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> Limitation to one set of characters brings, in other words, an expression of fatigue. Expression of fatigue also brings a gradual narrowing of the range of conditions under which the variety remains normal and uniform. With many closely selected varieties of plants seed has to be raised in one particular locality. Even a slight change in the expression of the environmental characters is likely to disturb the processes of descent and reveal their degenerate state. Sometimes the removal of selected varieties to new conditions calls forth large numbers of degenerative variations, and sometimes a notable change occurs in a whole planting as though a simultaneous mutation of all the individuals had taken place.[1]
>
> Wide variability is the most efficient means of acclimatization, and only species with many elementary units would have offered the adequate material for introduction into new countries. * * * From this discussion it would seem that it is more reasonable to assert that variability is one of the causes of the success of cultivation than to assume that cultivation is a cause of variability at large.[2]

These observations on the behavior of plant varieties have been made within quite recent years and evidence is rapidly accumulating to show that an influence upon variation is produced by the transplanting of plants from one region to another. The proper understanding of these variations by the breeder is becoming more and more a part of his profession.

The observation has been made that in polyembryonic seeds the plants which spring from the nucellar tissue by budding in close contact with or even extending into an embryo sack containing a hybrid embryo which is the result of cross-fertilization, show signs of increased vigor, though retaining the general characters of the variety; and the possibilities of breaking up a species and starting it to vary in ways unknown before by crossing on it, to start with, a form which is close enough to be congenial and then, when the varia-

[1] Cook, O. F. Heredity Related to Memory and Instinct. The Monist, vol. 18, No. 3, July, 1908, pp. 368 and 373.

[2] De Vries, Hugo. Species and Varieties, Their Origin by Mutation, 1905, p. 66.

tions have been started, using species which are more remotely related to it and which refused to cross with it before seem, according to the studies of Mr. W. T. Swingle, to open up new fields of research. The direct utilization of first-generation hybrids in such field crops as corn and the production of the hybrid seed on a commercial scale, as well as the possibilities of propagating asexually by means of cuttings sterile hybrid plants of which we utilize only the vegetative parts, as in the case of alfalfa, or of fertile hybrids which produce abundant seeds, but from the seeds of which undesirable degenerate varieties arise in the next generation, is a promising new opening for investigation. These features are suggestive of the close work which plant breeders are doing and illustrate the most important fact that they realize that the substance they are working with, protoplasm, is not merely a chemical one but one which has a structure that permits the most varied and intricate reactions to go on at the same time within the narrow confines of a single cell.[1]

THE INFLUENCE OF THE INTRODUCTION OF NEW SPECIES.

The influence which the introduction of a single new species may sometimes have on the creation of a whole range of new varieties is nowhere more strikingly demonstrated than in the case of the introduction of the Bengal rose into Europe. As Viviand-Morel [2] remarks in his article on the hybridization of the genus Rosa:

> The changes that upset the genus Rosa were contemporary, or nearly so, with the French Revolution. It was about this time, in fact, that there was introduced into cultivation the rose called "the Bengal," which transformed the genus and altered it from top to bottom.

According to the English gardener, Philip Miller, who wrote in the eighteenth century, there were only 30 varieties of double roses in cultivation in his time. Compare this number with the 2,000 or more of to-day. What has been done with the rose probably can be done in greater or lesser measure with many of our other cultivated plants.

In other words, plant breeding is now on the very borderland of our knowledge of the microscopic structure and chemistry of protoplasm on the one hand and touches the great commercial interests on the other, and therefore its study has all the fascination of true research which is stimulated by the quick utilization of newly discovered facts.

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[1] Alsberg, Carl L. Mechanisms of Cell Activity. Science, n. s., vol. 34, No. 865, 1911, p. 3.

[2] Viviand-Morel, J. V. On the Hybridization of the Genus Rosa. Journal of the Royal Horticultural Society, 1904, vol. 29, parts 1, 2, and 3, p. 41.

EXTENT OF THE WORK OF THE OFFICE OF FOREIGN SEED AND PLANT INTRODUCTION.

To stimulate this research and make it possible for a growing number of enthusiasts to breed plants with intelligence, the Office of Foreign Seed and Plant Introduction has been importing from various parts of the world the wild relatives of our cultivated plants and such promising wild forms as seem to offer a chance for domestication.

When one canvasses the whole world for the varieties of one of our cultivated plants it is surprising to find how many forms there are. In 1907, for example, when the systematic work of bringing in soybean varieties for the Office of Forage-Crop Investigations first began, there were known in this country only 23 varieties. In a recent bulletin of the Bureau of Plant Industry 300 are mentioned as having been tested.[1] These forms have been gathered since 1907 from the bazaars of oriental villages or bought from peasants in Japan, India, China, Siberia, Chosen (Korea), and the Dutch East Indies by trained explorers, American consuls, missionaries, or special correspondents.

The extensive experimentation in the selection and breeding of the cowpea which has been made by the Office of Forage-Crop Investigations is an example of the value of making a comprehensive collection of the varieties of a well-known cultivated crop, notwithstanding the fact that no new variety imported has yet proved superior to the noted Whippoorwill variety.[2]

THE IMPORTATION OF SPECIES OF DIOSPYROS.

No doubt there are skillful men really interested in the improvement of our common persimmon who do not realize that this American species is only one of a great genus of plants of which botanists have gathered over 200 species on their collecting trips. Nor do they realize that there are among these forms a large number which have edible fruits quite as palatable as the persimmon of our Atlantic coast. To help the breeders who were really interested in this great fruit crop the explorers of the department and its correspondents were notified that relatives of the persimmon were wanted. Careful descriptions, with photographs copied from botanical books, of the best forms desired were sent out when necessary. The result is that there have been imported during the past 14 years at least 18 species. The map (fig. 13) will give some idea of the range of the earth's surface over which this search has already extended, but it really has

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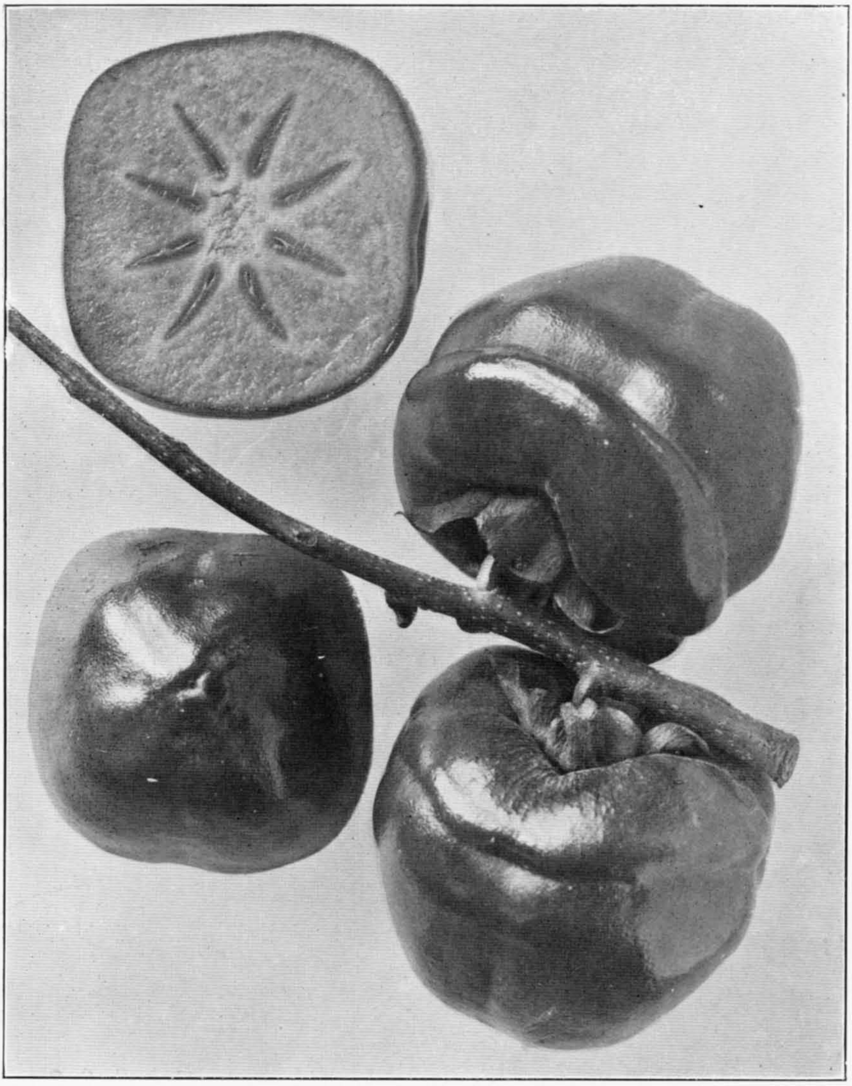
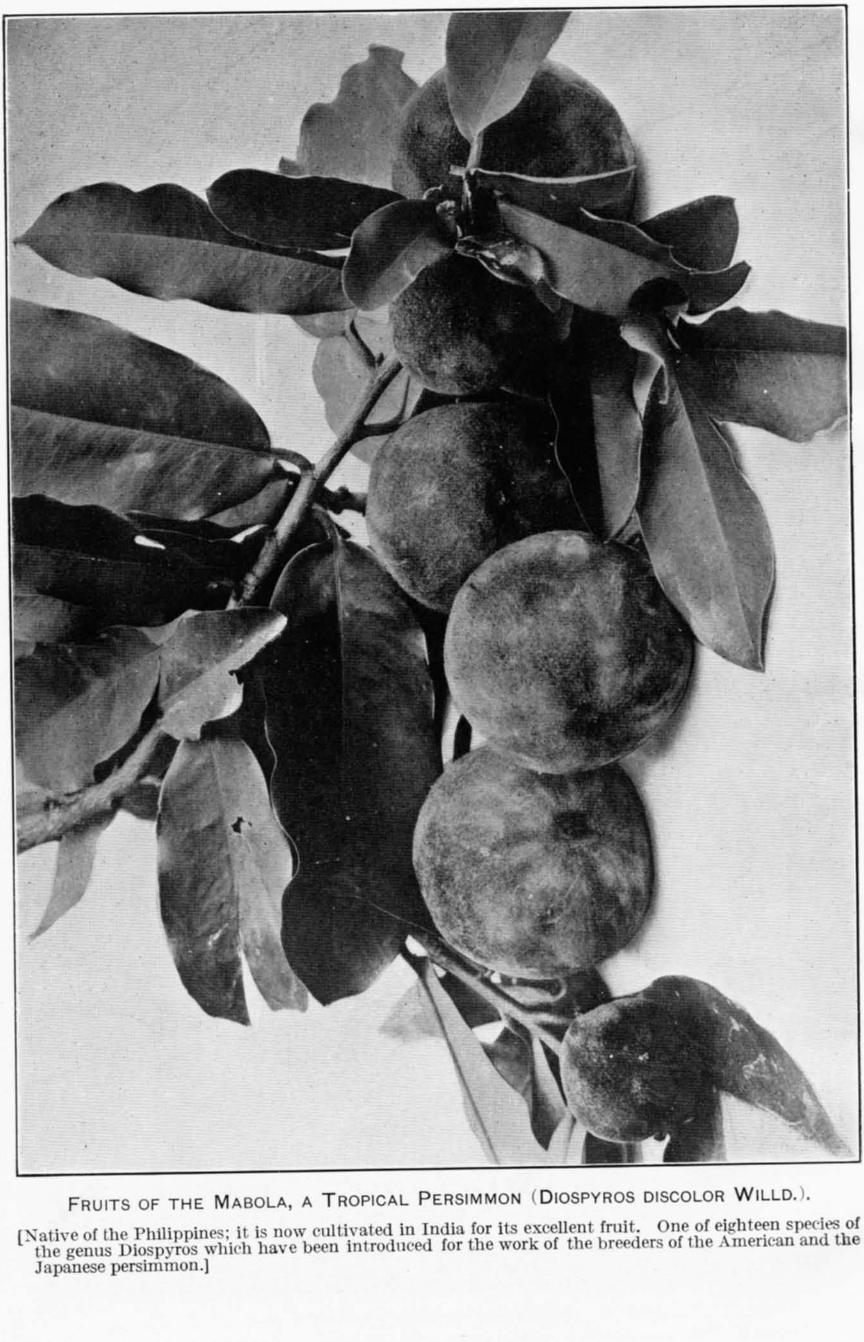
[1] Piper, C. V., and Morse, W. J. The Soy Bean; History, Varieties, and Field Studies. Bul. 197, Bureau of Plant Industry, U. S. Dept. of Agriculture, 1910, p. 24.

[2] Piper, C. V. Agricultural Varieties of the Cowpea and Immediately Related Species. Bul. 229, Bureau of Plant Industry, U. S. Dept. of Agriculture, 1912.



FRUIT OF THE LOTUS FLOWER PERSIMMON.

[A form from Chihli, China, with striking fruits which are quite seedless. One of the new oriental forms introduced for breeding purposes.]



FRUITS OF THE MABOLA, A TROPICAL PERSIMMON (DIOSPYROS DISCOLOR WILLD.).

[Native of the Philippines; it is now cultivated in India for its excellent fruit. One of eighteen species of the genus Diospyros which have been introduced for the work of the breeders of the American and the Japanese persimmon.]

FIG. 1.—FRUITS OF THE DESERT LIME (ATALANTIA GLAUCA (LINDL.) HOOK. F.).

[Probably the hardiest of all evergreen citrus species. A form with thick, leathery leaves from a location in Queensland, Australia, where very heavy frosts occur. The small fruits are edible.]

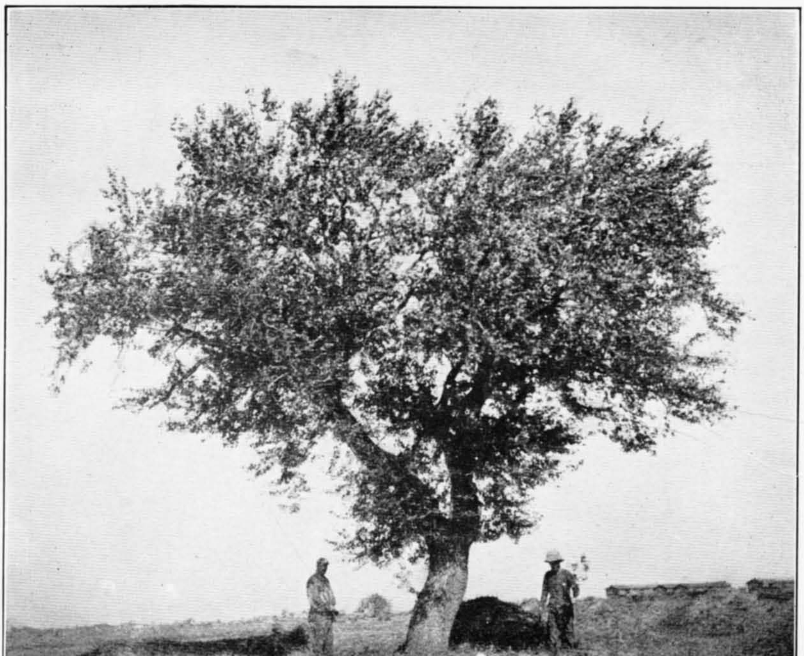


FIG. 2.—A TREE OF A WILD PEAR OF CHINA.

[This species (*Pyrus betulaefolia* Bunge) is used in China as a stock. It grows easily from cuttings and stands alkali remarkably well.]

FIG. 1.—A WILD APPLE IN CHINESE TURKESTAN.

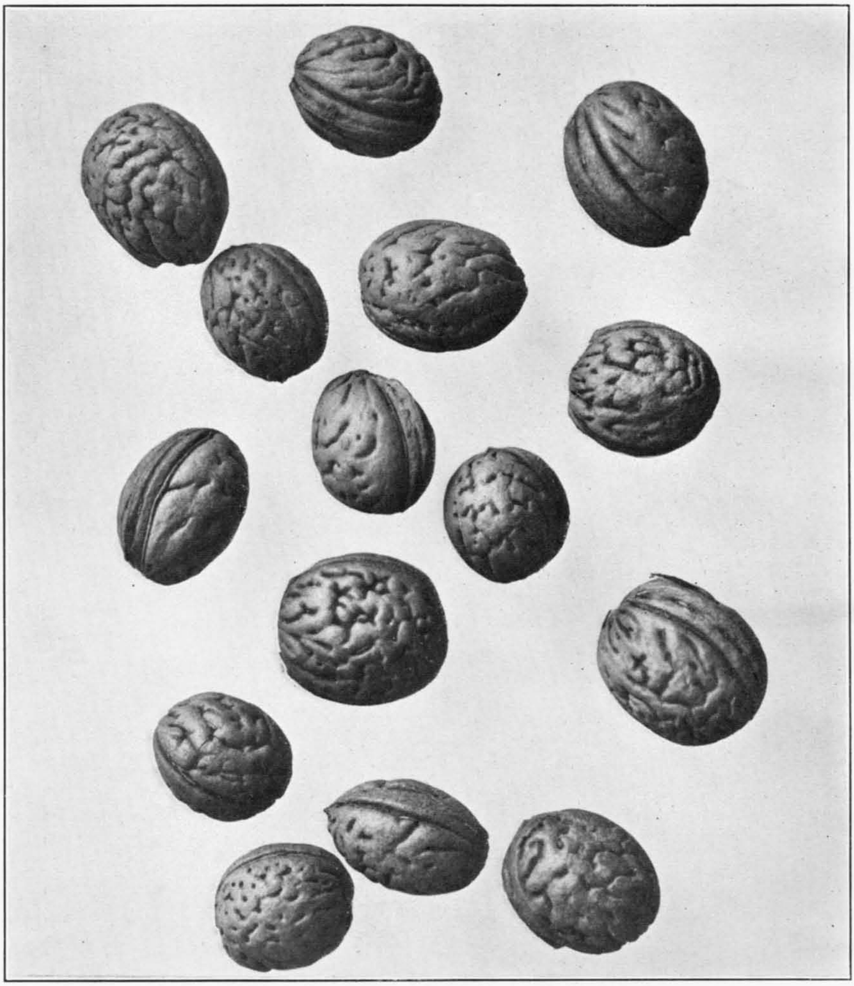
[Mr. Frank N. Meyer reports that the resistance to cold and drought of this wild form is quite remarkable, and he predicts that it will be an important factor in creating hardier races of apples for the Upper Mississippi Valley.]

FIG. 2.—A CHINESE BUSH CHERRY ORCHARD IN THE MING TOMBS VALLEY, NORTHWEST OF PEKING.

[This low-growing cherry is grafted on the wild-peach stock. It may prove of decided value to the breeders of bush cherries.]

A TREE OF A SHRUBBY WILD PEAR FROM THE CAUCASUS.

[This species (*Pyrus salicifolia* Pall.) is able to grow on the hot, dry mountain slopes, where only junipers thrive. It may prove useful to breeders as a new dwarfing stock for the pear.]



STONES OF THE CHINESE WILD PEACH, NATURAL SIZE.

[This wild species (*Amygdalus davidiana* (Carr.) Dippel) is used commonly as a stock for stone fruits in China. It is remarkably hardy and drought resistant and has been introduced for stock and breeding purposes.]

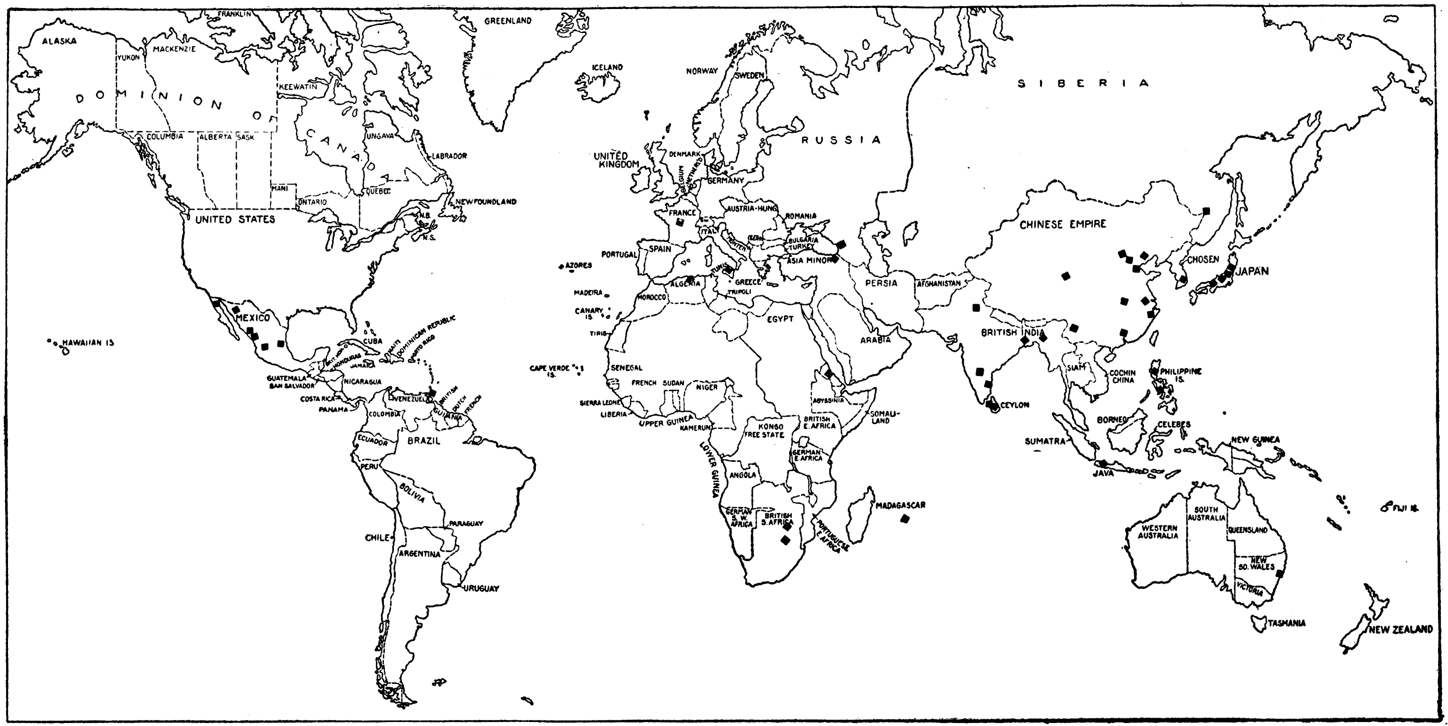


FIG 13.—Map showing the distribution of species of Diospyros introduced into the United States since 1897.

Species.	Introductions.	Species.	Introductions.	Species.	Introductions.	Species.	Introductions.	Species.	Introductions.
Diospyros affinis	1	Diospyros ebenaster	1	Diospyros lotus	16	Diospyros montana cordifolia	1	Diospyros tupru	1
attenuata	1	ebenum	4	lucida	2	moonii	1	senegalensis	3
cauliflora	1	insignis	1	macrophylla	1	peregrina	2	species undetermined	17
discolor	7	kaki	107	microcarpa	1	tesselaria	4		

These species and varieties were introduced with the object of encouraging the work of breeding them with the American species of persimmon (*Diospyros virginiana* and *Diospyros texana*), and the Japanese kaki (*Diospyros kaki*), which is already grown in the Southern States.

only begun. Until the plant breeder has had an opportunity to make the acquaintance of all of these which bear edible fruit he can not be said to have exhausted the possibilities of the genus. Even then he may find that there is among the species without edible fruits one which has some particular character that will make it valuable for breeding purposes. The use of the plant as a stock might be invaluable even though its fruits were worthless. In point of fact one of the recently introduced species of Diospyros (*D. lotus*) has fruits (Pl. XLIII) but little better than, if as good as, the Virginia persimmon, but its roots are more fibrous, and the plant does not form a long taproot as does the Virginia species. For this reason it is easily transplanted, while the common American species is among the most difficult of fruit trees to transplant.

This search for the relatives of the persimmon, which is taken merely as an example of the character of the work which this article desires to emphasize, has revealed entirely new types of the large-fruited oriental persimmon (*Diospyros kaki*). There are several varieties with fruits which are puckerless even when they are as hard as apples; others which are characterized by trees of immense size and an apparently higher age limit than anything that American growers have known of heretofore; in another variety the element of seedlessness is combined with unusual size of fruit, while a precociousness which makes plants 2 feet high and 4 years old bear a heavy load of fruit is possessed by another.

The breeder has now at his disposal the following characters: Long life; large size of tree; precociousness; great variety of form, color, flavor, and size of fruit; seedlessness; a root system which is easily transplanted; freedom from astringency; and in the tropical forms which are not so well known a number of characters such as the firm cream-colored flesh of *Diospyros discolor* (Pl. XLIV), native of the Philippines but now much cultivated in India.

But we have in our own country two species of persimmons, both of which have most valuable characters, the common Virginia persimmon (*D. virginiana*) and the Texas species (*D. texana*), the former of which refuses to bud out in the spring until the cold weather is really over, and hence is not injured by the freezes which follow the February thaws of the South, while the latter, although tender, is extremely resistant to droughts, endures a highly calcareous soil, and bears large crops of a fruit which is unusually sweet.

Can not these invaluable characters be made the basis of entirely new races of fruit, and crosses be effected between the oriental and the occidental persimmon which will combine the large size and attractiveness of the former with the hardiness and resistance to drought of the latter?

THE COOPERATION OF AMATEURS NECESSARY IN PLANT BREEDING.

When one considers the years which will pass before these different species that are introduced will be hybridized and their progeny bear fruit, one is inclined to feel dismayed at the magnitude and difficulties of the problem.

If one were dependent upon the production of a superior strain for a livelihood it would indeed be a hazardous occupation. But with generous Federal assistance in getting the plant material and with the pleasure that goes with the hybridization of plants it is to be expected that an increasing number of men and women will seek their recreation, as they do in England and Japan, in the breeding and selection of our cultivated plants. It is also to be hoped that out of the many crosses there will be evolved in the future, as there have been in the past, but with more rapidity, greatly improved forms of those fruits which we now have and new kinds which are now quite unknown to us.

To encourage the formation of collections of these plants which are related to already domesticated species or seem capable of domestication is one of the main objects of plant introduction. Those who have been most closely engaged in the work of plant breeding seem to believe in the great value of the "personal collection." Not that they do not think there should be in the country a number of arboreta, certainly one at each agricultural experiment station, but the work of plant breeding is so preeminently a work requiring the undisturbed attention of the breeder during the early morning hours that the large laboratory and the large collection, from the very nature of their size, separate the breeder too far from his plants. The equipment of a large and well-stocked laboratory and extensive fields and nurseries may prove a decided illusion to the plant breeder. They seem not to furnish the ideal conditions which they are expected to provide, mainly because they separate the breeder himself from the plants which he wants to breed.

In looking over the historical accounts of the origin of the most promising varieties of our fruits one can not but be impressed with the fact that the great majority of them originated as chance seedlings. Fence corners, new clearings in the forest, neglected spots in the strawberry patch, or old nursery rows seem to be the birthplaces of some of the most famous of the cultivated varieties.[1] And when the fruit or nut under consideration is a new one to the country or to cultivation, like the avocado or the pecan, the list of varieties is made up almost exclusively of seedlings or bud variations which

[1] Taylor, W. A. Promising New Fruits. Yearbooks of the Department of Agriculture, 1901 to 1910. Out of 110 varieties of promising new fruits and nuts described, 70 per cent were of probable chance origin, while only 21 per cent were originated directly by breeders, and 9 per cent were introduced directly from abroad.

have been followed up by amateurs. It would be hard to estimate the debt which the world owes to the amateur, whose only reward has been the pleasure of discovery.

Plant breeding seems to be a peculiarly personal thing and the work of one individual is rarely taken up by another where it is laid down by his predecessor. Therefore a collection of plants for breeding purposes, even though in a permanent arboretum, loses a great deal of its value upon the death of the breeder who is at work with it. This being the case, there is good ground for the contention that the Government is amply justified in placing collections of plants in the care of individuals, even though they are subject to the unusual risks incident upon the death of the breeder or the sale of his property.

Naturally, in the introduction of new plant species and varieties for breeding purposes the demands of the official State and Federal experimenters have been earliest in coming in, but the number of amateurs who request importations is rapidly increasing. These cover a very wide range of plant species.

SOME RECENT IMPORTATIONS FOR PLANT BREEDERS.

In order to assist in the development of a tobacco that will be resistant to the Granville tobacco disease, 64 importations of tobacco have been gathered together. To assist in the improvement of the potato, 248 introductions of *Solanum tuberosum* from South America have been made. In attempting to aid in the production of a rust-resistant asparagus and the solution of certain important breeding problems connected with this genus, 35 different forms have been collected out of a possible hundred. With the idea of stimulating someone to breed the maypop (*Passiflora incarnata*) of our Southern States with the delicious-fruited species of the passion fruit of South America, Australia, and South Africa, about 70 importations have been made. To assist the breeders who are interested in the possibilities of the hybridization of the different species of poplars and cottonwoods, Mr. Frank N. Meyer has been recently collecting desert species in western Chinese Turkestan.

One of the greatest pieces of introduction work that has been done is that with the genus Medicago, which contains the important forage plants, alfalfa and bur clover. The world has been literally ransacked for seeds of every promising species, and three expeditions into Siberia have been made for the purpose of obtaining ample quantities of certain forms to enable the breeders to work together in the creation of superior drought and cold resistant forms for the Northwest and winter-growing varieties for the irrigated valleys of the Southwest.

In connection with the investigations to originate new types of citrus fruits by the Office of Crop Physiology and Breeding Investigations a striking new dry-land introduction has been made of a species related to the orange. This is the desert lime of Australia, which is shown in Plate XLV, figure 1. The importance of this for breeding purposes was pointed out by Mr. W. T. Swingle and the fact emphasized that it is a species which will stand frost, bears drought remarkably well, and already has edible fruits which, although small, are of fair quality for making preserves.

In response to the request of the plant breeders of the upper Mississippi Valley for material with which to solve their problem of cold-resistant fruits, Mr. Frank N. Meyer during the past two years has been making a thorough search on the cold and barren slopes of the Tien Shan Mountains and the desert regions of Chinese Turkestan for wild apples (Pl. XLVI, fig. 1), pears, peaches, apricots, plums, cherries, currants, and other fruits, and he reports the presence there of forests of wild apples, apricots, and almonds and the existence of remarkable bush cherries (Pl. XLVI, fig. 2) which are promising for the breeders of cold-resistant forms to work with.

Perhaps there is no plant which has been brought in recently that has attracted so much attention among breeders as the Chinese wild peach (*Amygdalus davidiana*). (Pl. XLVIII.) Trials with it have already shown that it can stand more cold than the hardiest variety of peach in Iowa, that it promises to be a very valuable stock in California, and it has stood the extreme heat of the Southwest in a remarkable way. Whether it can be hybridized with the ordinary peach remains to be seen, but certainly it is deserving of a place in the home collection of every fruit breeder. It is not yet known whether it will prove resistant to the peach yellows. Its resistance should certainly be tested.

Expeditions made by the veteran horticulturist, Mr. G. Onderdonk, of Nursery, Tex., into the peach regions of Mexico have resulted in the selection of at least one variety of peach which promises to be of distinct value in central Texas.

It is a recognized fact that the Chinese pears and their American descendants, the Kieffer and Le Conte, are not affected by the pear blight which attacks and destroys whole orchards of the more delicate varieties that have come to us from Europe. With the possibility of creating superior blight-resistant varieties which shall be of better quality than these cooking pears, all of the best varieties which can be found in China and central Asia are being assembled for the use of the pear breeder. (Pl. XLV, fig. 2; Pl. XLVII.)

The walnut growers are looking around for disease-resistant varieties. The chestnut breeders know of the immunity of the Japanese chestnut to the chestnut bark disease and are trying to produce a sweeter variety of this hardy species. The wheat breeders are testing the newly discovered wild emmer from Palestine in their breeding experiments. The cotton varieties which have been selected from varieties of Egyptian origin promise a paying industry in the Yuma region of Arizona. The Sudanese and Chinese Kafir corn contain varieties of great value for the selection of better strains of this great grain crop. The Sudan forage grass, a stolonless species related to our Johnson grass, but of great promise as a forage crop, is developing a series of valuable variations in the hands of the experts of the Office of Forage Crop Investigations.

There is, in fact, scarcely an important plant industry in the country upon which the breeders are at work which is not likely to be affected by the introduction of some foreign species and its skillful use in hybridization, and it is one of the most pleasurable parts of the work of plant introduction to search out and obtain for the plant breeders the species which they want.

PROMISING NEW FRUITS.

By WILLIAM A. TAYLOR, *Pomologist and Assistant Chief*, and H. P. GOULD, *Pomologist in Charge of Fruit District Investigations, Bureau of Plant Industry.*

INTRODUCTION.

Since fruit culture first began to receive serious and systematic attention in the United States the question of what varieties to plant has been an important one in the minds of fruit growers and in the deliberations of horticultural and pomological societies.

That this matter will continue to need attention for many years to come is inevitable. Fruit culture is constantly being extended into new regions where new conditions or combinations of conditions of climate, soil, etc., exist; new marketing facilities are developed; and changes in the market demands occur. These factors influence in a marked degree the selection of varieties of fruits for planting by the more discriminating and farsighted fruit grower. More and more are varieties being planted to meet particular conditions and for special rather than for general purposes.

In this perpetual effort to obtain better varieties and such ones as will more satisfactorily meet particular needs, sorts that have long been in cultivation but which have remained largely in obscurity sometimes come into prominence because of their adaptability for some new requirement. Such varieties have frequently been included in the series of articles of which the present paper is a continuation.

The varieties described in this article have been selected because of the value which they are believed to possess in the further development of fruit culture.

The Department of Agriculture has no stock of these varieties available for distribution.

CORNELL APPLE.

SYNONYMS: *Cornell's Fancy, Cornell's Favorite.*

[PLATE XLIX.]

EARLY HISTORY.

The Cornell apple, strictly speaking, is not a new variety, yet it is unknown to a large proportion of growers. It has apparently been in existence for 100 years, or perhaps longer. What appears to be an authentic account of its origin, published in 1869,[1] states that "The Cornell's Fancy Apple originated some sixty or seventy years ago on the farm of Gilliam Cornell, near the Street road, in Southampton Township, Bucks County, Pa."

From the dates mentioned it is evident that this variety originated in the last part of the eighteenth or the first part of the nineteenth century.

The original tree appears to have been a fence-row seedling. In its early years it attracted considerable local attention, and many scions of it were distributed in adjoining portions of Philadelphia and Montgomery Counties, Pa. The first published description of it appears to have been that of Downing in 1857.[2]

DESCRIPTION.

Form oblong conic; size medium to large; cavity regular, sometimes slightly irregular, usually large, rather deep, slope gradual, with russet markings; stem medium to long, moderately stout; basin usually regular, of medium size and depth, with gradual slope usually, sometimes furrowed or corrugated; calyx segments medium, converging; eye small to medium, closed; surface smooth, sometimes more or less ribbed; color creamy or yellowish white, washed with mixed red, striped with bright crimson, and slightly overspread with gray; dots usually rather large and conspicuous, occasionally minute, often aureole, grayish, sometimes brownish; skin rather thin, usually tender; flesh yellowish white, fine grained, very tender, moderately juicy; core conical, clasping, medium in size, slightly open; flavor mild subacid, pleasant; quality good to very good. Season August in middle latitudes.

The tree has been reported to lack vigor in some sections, but apparently in regions to which the variety is well adapted it makes a good growth and is usually productive. The fruit should not be left on the tree too long, as it has a tendency to crack and become mealy when fully ripe. Though it has become quite widely disseminated, it is grown only in very limited quantities and is largely unknown in the markets. In the further extension of early-apple culture it is believed that it can be made an important sort in middle latitudes.

The specimen illustrated in Plate XLIX was grown by Thomas O. Duvall, Burtonsville, Montgomery County, Md.

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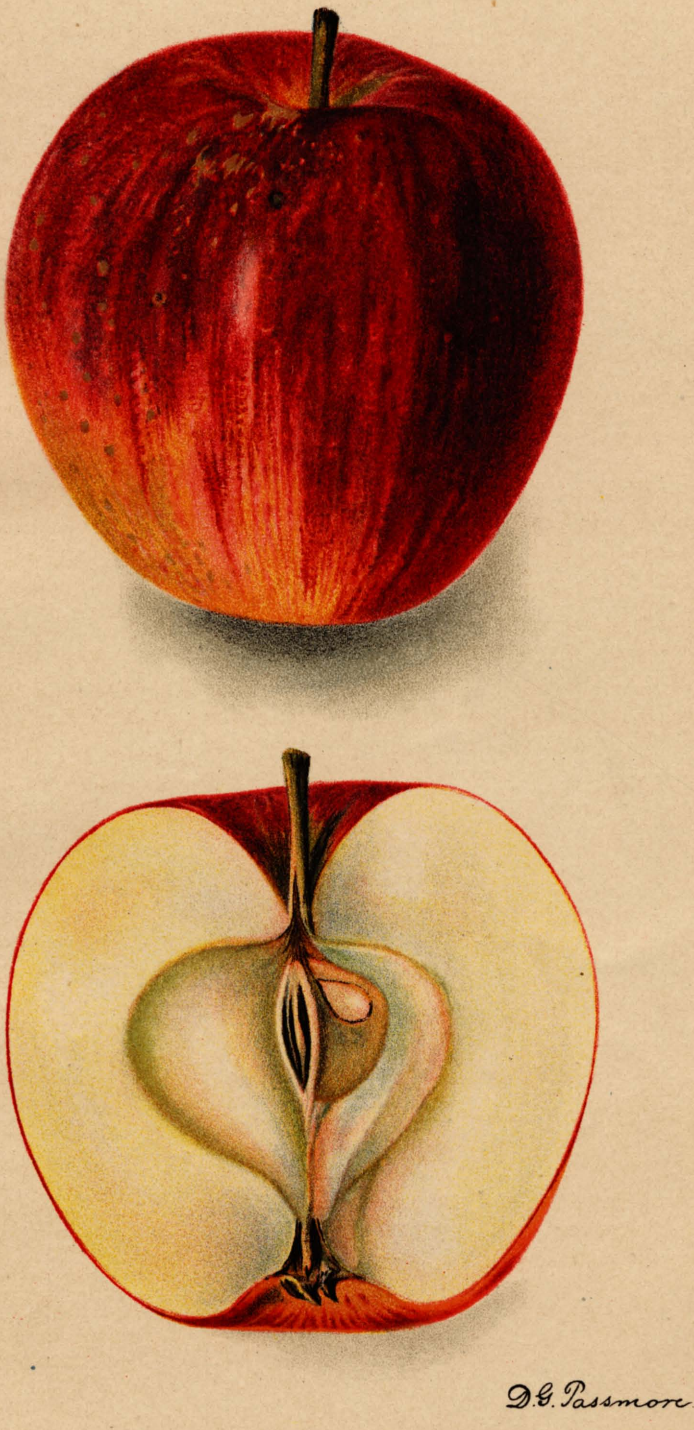
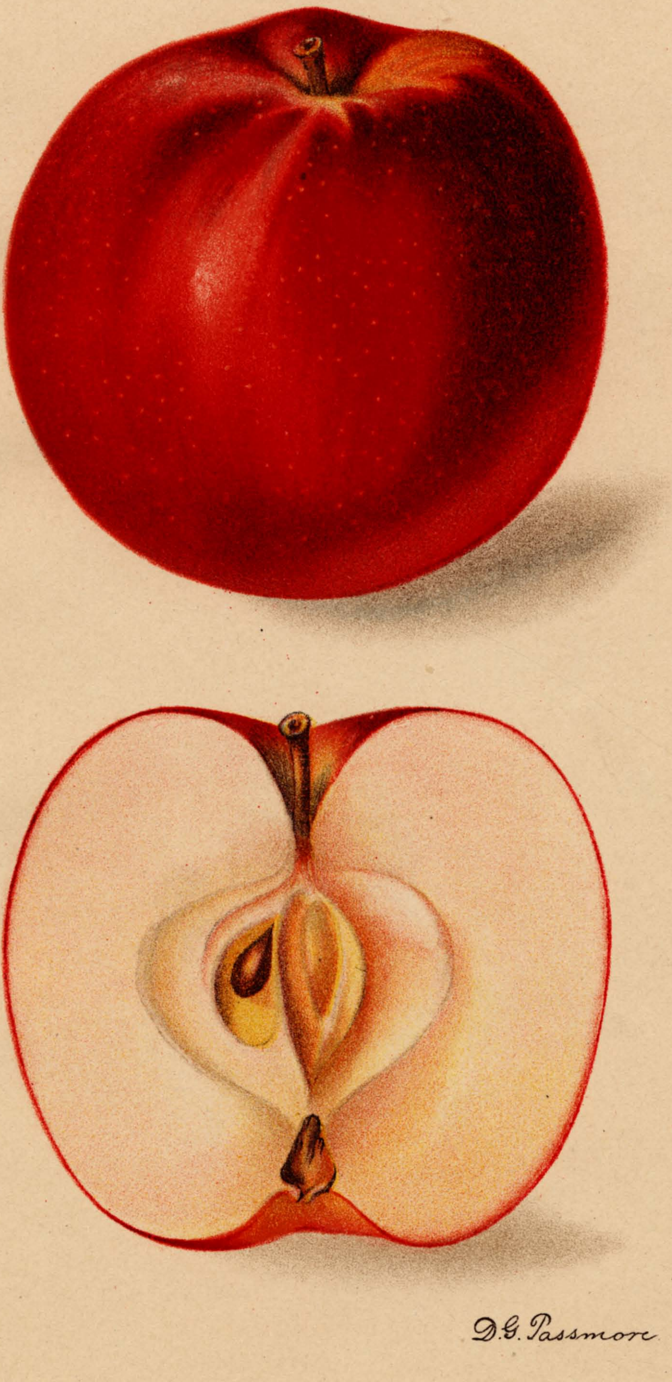
[1] The Gardener's Monthly, vol. 11, 1869, p. 376.

[2] Downing's Fruits and Fruit Trees of America, revised edition, 1857, p. 131.



CORNELL APPLE



SAN JACINTO APPLE

SHIAWASSEE APPLE

A. HOEN & CO. BALTIMORE.

AYER PEAR

SAN JACINTO APPLE.

SYNONYM: *Mrs. Bryan*, erroneously.

[PLATE L.]

EARLY HISTORY.

The San Jacinto apple appears to have first come to light in the orchard of Dr. A. M. Ragland, of Pilot Point, Denton County, Tex., under the following circumstances:

About 1881 or 1882 he obtained 12 apple trees under the name "Mrs. Bryan" from a Georgia nursery.[1] When these trees came into bearing, four of them produced fruit which was entirely distinct in size, color, and time of ripening from the fruit borne by the other 8 trees, which were true to name. After several years of fruiting, Dr. Ragland was so favorably impressed with the value of the fruit from these four trees that he had the variety propagated. In the year 1900 it was propagated by T. V. Munson & Son and listed for sale in a catalogue issued in 1902 under the name "Mrs. Bryan," the fact that it differed from the variety entitled to that name not having been established at that time.

Meanwhile doubt had arisen as to which of these two varieties was the true "Mrs. Bryan." Specimens of the fruit were submitted to the proprietors of the nursery from which the trees came, but they were unable to identify them, having never seen a variety like these specimens so far as they knew. Specimens were also sent to Mrs. J. W. Bryan, of Dillon, Dade County, Ga., on whose place the Mrs. Bryan apple originated. She did not recognize the variety, but was positive that it was not the "Mrs. Bryan."

It having become evident that the identity of this variety was entirely unknown up to this time to the parties who were chiefly concerned and in view of the apparent value of the variety for southern latitudes and the interest which it was attracting it was named "San Jacinto"[2] by Dr. Ragland, in honor of the battle of San Jacinto, which took place on April 21, 1836, near the mouth of the river of that name and which resulted in the establishment of Texas as an independent republic.

In the fall of 1903 this variety was listed for sale under its present name in the catalogue of the Munson Nurseries, Denison,[3] Tex., this being, so far as known, the first publication of the name.

Since the fact that it is distinct from "Mrs. Bryan" became evident some 8 or 10 years ago, its history has received more or less con-

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[1] Letter from Dr. A. M. Ragland, December, 1911.

[2] Letter from Mr. T. V. Munson, December, 1911; also letter from Dr. A. M. Ragland, December, 1911.

[3] Letter from Mr. T. V. Munson, December, 1911.

stant consideration, but no older tree of the same variety has been discovered to which the four trees planted in Dr. Ragland's orchard about 30 years ago can be traced. Apparently all of the trees of the variety which have been planted since it began to attract attention some 10 or 12 years ago trace directly to Dr. Ragland's orchard. It is now propagated under the name "San Jacinto" by a considerable number of nurseries.

DESCRIPTION.

Form roundish to oblong oval; size medium to large; cavity irregular, medium in size and depth, slope rather abrupt with russet markings, sometimes lipped; stem of medium length, fairly stout; basin regular, medium to large, slope gradual, more or less furrowed; calyx segments rather long, converging; eye medium to large, closed; surface smooth, except some slight ribbing; color yellowish to greenish white, washed with suffused red over nearly the entire surface, with few splashes and stripes of bright crimson; dots numerous, sometimes indented; skin medium thick, tenacious; flesh white or yellowish, sometimes slightly tinted; texture medium fine, breaking, juicy; core oval or conical, clasping, of medium size, open; flavor subacid, pleasant; quality good to very good. Season in northern Texas from the first of July until the middle of August, the main portion of the crop following the Red June apple.

The tree resembles the Red June, but it is a more vigorous grower than that variety. It begins bearing early and is proving productive. The fruit is also quite like the Red June type, and there is some reason for supposing that it is a seedling of that old and widely grown southern variety.

It seems to be particularly well adapted to southern latitudes, being one of the most satisfactory apples of its season in northern Texas, Oklahoma, and other southern and southwestern points.

The specimen illustrated in Plate L was grown by Dr. A. M. Ragland, Pilot Point, Denton County, Tex.

SHIAWASSEE APPLE.

SYNONYMS: *Shiawassee Beauty, Missoula.*

[PLATE LI.]

EARLY HISTORY.

Though the Shiawassee apple has been in cultivation for 60 years or more, it is grown but comparatively little. Its early history, as given by the late T. T. Lyon, is as follows:

The fruit originated from the pomace of a lot of grafted fruit grown in a nursery in Gaines, Genesee County [Mich.]. A portion of the trees grown from them were sold, ungrafted, to Mr. Beebe Truesdell, deceased, who planted them in Vernon, Shiawassee County. Among these was the original tree of this variety, which has now borne full and regular crops for more than 10 years, with the exception of two seasons, when the crop was thinned by frost.[1]

This variety belongs to the Fameuse group of apples, as does the McIntosh,[2] and is commonly supposed to be a seedling of Fameuse, which was a well-known variety in Michigan at the time when Shiawassee originated.

DESCRIPTION.

Form oblate, sometimes slightly conical; size medium to large; cavity broad, deep, rather abrupt; stem of medium length, moderately stout; basin regular, large, with gradual slope; calyx segments medium, converging, sometimes reflexed at tip; eye small to medium, open or partially closed; surface smooth; color pale yellow, washed over nearly the entire surface with mixed crimson stripes of purplish red, sometimes thinly overspread with gray; dots rather scattered, usually small, sometimes more conspicuous, grayish or yellowish in color; skin moderately thick, fairly tenacious, sometimes covered with a light bloom; flesh white, sometimes very lightly tinted with red, fine grained, tender, juicy; core conical or oblate conic, clasping, of medium size, open; flavor subacid, aromatic; quality very good. Season October to January.

It has been quite widely though not extensively grown throughout the older apple-producing regions of the Northern States and also in some of the Canadian Provinces. The tree is a strong, upright grower, but the branches become more or less drooping as it attains age. It is more highly esteemed for and is perhaps better adapted to home use than it is for general commercial purposes, but its high quality and attractive appearance, together with its productiveness, make it a variety of more than average merit for northern apple-growing regions. The tree is considered as hardy as the Fameuse, which indicates its adaptability to all but the colder apple regions. It is less susceptible to apple scab than the Fameuse, but sometimes shows a tendency to rot at the core.

Attention has been more or less directed to the Shiawassee apple in the Bitter Root Valley of Montana in recent years, because of its apparent usefulness in pollenizing the McIntosh apple, the latter being a leading commercial variety in that region. As its identity in the Bitter Root Valley, however, was unknown until recently, it has been locally propagated there under the name "Missoula."

The specimen illustrated in Plate LI was grown by H. C. and M. D. Ward, Pontiac, Oakland County, Mich.

[1] Michigan Farmer, Nov. 12, 1859, and Hovey's Magazine of Horticulture, February, 1860, p. 64.

[2] For illustration and description, see Yearbook, U. S. Dept. of Agriculture for 1901, p. 383.

AYER PEAR.

[PLATE LII.]

EARLY HISTORY.

The Ayer pear originated about 30 years ago, as a chance seedling which came up in a vineyard owned by Mr. O. H. Ayer, near Sibley, Douglas County, Kans. The small seedling tree had made a growth of only two or three leaves when discovered. Mr. Ayer had a spade with him at the time and transplanted it at once to a point just outside the vineyard, where it is still standing.[1] It was much neglected for some years and was rather late in coming into bearing, not fruiting until it was about 10 years old.

The tree is a rather slow, upright grower, similar to the Bartlett tree in form, but the foliage is dark colored like that of the Seckel. The owner is inclined to think it is a seedling of the latter, as a tree of that variety stood only a few rods distant from the place where the original tree first appeared. His assumption is that some one in passing through the vineyard while eating a Seckel pear from the nearby tree of that variety threw the core on the ground, and that the tree in question grew from one of the seeds which it contained. It has been propagated to a very limited extent, but not disseminated commercially.

DESCRIPTION.

Form obovate; size medium; cavity irregular, medium to large, depth medium, slope rather gradual, marked with russet folds or wrinkles; stem of medium length, moderately stout; basin regular, medium in size and depth, slope gradual, with shallow corrugations and russet markings; calyx segments short, sometimes rather fleshy, converging or slightly reflexed; eye medium, open or partially closed; surface somewhat undulating, moderately smooth, with some russeted areas; color light greenish or pale lemon yellow, frequently with a light-scarlet blush on exposed side; dots numerous, minute, russet; skin thin; flesh whitish or yellowish white, fine grained, buttery, melting, juicy; core oval, clasping, of medium size, closed; flavor mild subacid, rich; quality very good, fairly comparable with Seckel. Season in eastern Kansas the last of July and early August—two or three weeks earlier than the Bartlett.

From Mr. Ayer's observation of this variety he is inclined to think it is self-sterile. Up to the present time the tree has shown no tendency to blight, its rather slow habit of growth favoring it in this respect. In productiveness it is said to be about equal to the Bartlett.

Though the range of adaptability of this variety has not been determined, the high quality of the fruit and the degree of blight

[1] Letters from Mr. O. H. Ayer, November, 1911.

resistance which the tree has shown thus far suggest the probability of its possessing considerable merit for the Middle West.

The specimen shown in Plate LII was grown by Mr. O. H. Ayer, Sibley, Douglas County, Kans.

RUSSELL PEACH.

SYNONYM: *Russell No. 1.*

[PLATE LIII.]

In the development of new peach varieties with a view to extending the culture of this fruit, especially in middle and northern latitudes, improvement along the line of increased hardiness offers, perhaps, a wider field for advancement than almost any other. Any variety which possesses merit as to dessert and shipping qualities, productiveness, etc., and which can withstand without injury unusually low temperatures in winter or early spring is likely to prove an important factor in the peach industry as soon as its characteristics become generally known. The Russell peach appears to be a variety which possesses these qualities to a considerable degree.

EARLY HISTORY.

This variety originated at Wymore, Gage County, Nebr., about the year 1890, in an experimental seedling orchard belonging to J. M. Russell & Son, who at that time had a peach orchard of budded varieties at Wymore consisting of 65 acres.

The trees in the seedling orchard were produced from seeds selected from their best and hardiest varieties. The one in question grew from a seed of the Chili (*Hills Chili*) peach. Some of the characteristics of the tree and fruit are similar to the Alexander peach, and in view of the fact that a tree of that variety stood close to the Chili tree which produced the seed from which the Russell tree developed, there is some reason for supposing that it is a cross between these two varieties.

The first crop of fruit borne by this tree was in 1893, when it produced about 1 bushel.

This variety was originally designated as "Russell No. 1," and under this name it was briefly described by Mr. J. M. Russell in 1894.[1] Later, Messrs. Russell & Son developed the "Russell No. 2" and "Russell No. 3," but neither of these was disseminated to any extent.[2] Under the name "Russell" it was described in the report of the assistant pomologist in 1893.[3] This report, however, was not published until some time during the year 1894.

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[1] Annual Report, Nebraska State Horticultural Society, 1894, p. 116.
[2] Letter from J. M. Russell & Co., November, 1896.
[3] Report of the Secretary of Agriculture, 1893, p. 291.

DESCRIPTION.

Form roundish; size medium to large; cavity regular, medium to large, deep, gradual; suture shallow except at cavity, extending from cavity to beyond the apex; apex a small point in the suture, in a slightly depressed basin; surface soft, velvety; color creamy white, blushed and splashed with crimson; down medium short, easily removed; skin thin, tender; flesh greenish white, with yellowish veins, tinged with red at stone, tender, melting, juicy; stone oval, free, small; flavor mild subacid, pleasant; quality good to very good; tree a rapid grower and an early and prolific bearer; glands globose. Season a month later than the Alexander peach, or about the middle of August, in southeast Nebraska.

This variety, though apparently not grown extensively, has become quite widely distributed in Nebraska, Iowa, and other middle western sections, where it is one of the most reliable bearers. It has proved to be one of the hardiest early freestone varieties, both in tree and bud, having endured with but slight injury winter temperatures which seriously damaged most other varieties.[1] The fruit, however, is said to be somewhat susceptible to brown-rot.

A late peach ripening in October, which originated at Lincoln, Ill., was introduced about the year 1894 under the name "Russell" and was distributed to some extent by a nursery located at that place. This variety does not appear to have become widely disseminated, and so far as known the name "Russell" as applied to this particular sort has been published only in the catalogues of the nursery company which disseminated it. That variety has not been propagated by this company since 1903.[2]

The specimen illustrated in Plate LIII was grown by Mr. F. O. Harrington, Williamsburg, Iowa County, Iowa.

LAIRE PLUM.

[PLATE LIV.]

EARLY HISTORY.

The Laire plum is a native variety which has gradually assumed much regional importance during the last few years. A recent investigation of the botanical status of this plum made by Mr. W. F. Wight, of the Bureau of Plant Industry, indicates that it is very closely related to *Prunus orthosepala* Koehne and may properly be considered a form of that species.

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[1] Letter from Prof. R. F. Howard, Nebraska Agricultural Experiment Station, Dec. 11, 1911.

[2] Letter from Mr. W. E. Jones, December, 1911.

The Laire plum appears to have been brought into cultivation in the spring of 1876[1] by Mr. Abram Laire, living near Kirwin, Phillips County, Kans., and for whom it was named. It began fruiting two years after being brought in from the wild state. In a personal interview with Mr. Laire in September, 1910, he informed Mr. Wight that the original trees were obtained about 1878 or possibly a year or two later, the exact date apparently not being a matter of definite record. Mr. Laire, with his son, collected a number of young plum trees from various localities along Bow Creek. When these trees came into bearing there were about half a dozen which produced fruit of superior merit. The fruit of these trees was apparently the same, the trees probably all having developed as suckers from a single parent tree. This variety is the one to which the name "Laire" was subsequently applied.

The thicket from which these trees were obtained could not be relocated after they fruited, though Mr. Laire's son is inclined to think that they came from one which meanwhile had been destroyed by cattle.

DESCRIPTION.

Form roundish; size medium for a native variety; cavity regular, small, of medium depth, with gradual slope; stem short, very slender; suture very shallow, extending from cavity to apex; apex a small russet dot in a small basin at end of suture; surface smooth, glossy under bloom; color bright crimson yellow to dark red; dots numerous, russet; bloom profuse; skin thick, tenacious, slightly astringent; flesh yellow with whitish veins, meaty, juicy; stone roundish, cling, medium in size; flavor mild subacid, rich; quality good to very good; season September.

The Laire plum is a prolific bearer and is apparently especially well adapted to the central and western portions of Kansas and the corresponding regions of adjacent States. It was estimated in 1910 by Mr. E. Bartholomew that there were 100,000 trees of this plum growing in the northern central portion of Kansas.

That a fruit variety should have developed to so great a degree of importance in the region of its origin and remain largely unknown elsewhere is a rather remarkable occurrence in the recent annals of American pomology; that it represents, or is very closely related to, a species not recognized heretofore as possessing horticultural value is of interest, especially to those who are concerned in the amelioration of our native plums.

The specimen shown in Plate LIV was furnished by Mr. E. Bartholomew, of Stockton, Rooks County, Kans.

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[1] Letter from Mr. E. Bartholomew, September, 1908.

MONCELT PLUM.

[PLATE LIV.]

EARLY HISTORY.

The Moncelt plum is a seedling of the "Red Nagate,"[1] a Japanese variety, and originated about 12 years ago on the grounds of R. Bates, Jackson, Aiken County, S. C. He considers[2] it a hybrid between "Red Nagate" and "Clyman," a "domestica" variety, but the botanical characters of the twigs and foliage, and of the fruit as well, appear to be those of the Japanese plum (*Prunus triflora*).

The original tree began bearing when 4 years old. As soon as its merits were apparent, the name by which it is designated was awaiting it, this having been previously selected by the originator to apply to the most promising variety in a lot of more than 17,000 seedlings of the "Red Nagate" which he was testing.

The name Moncelt was first published in a small catalogue issued by the originator in March, 1911, when the variety was commercially introduced.

DESCRIPTION.

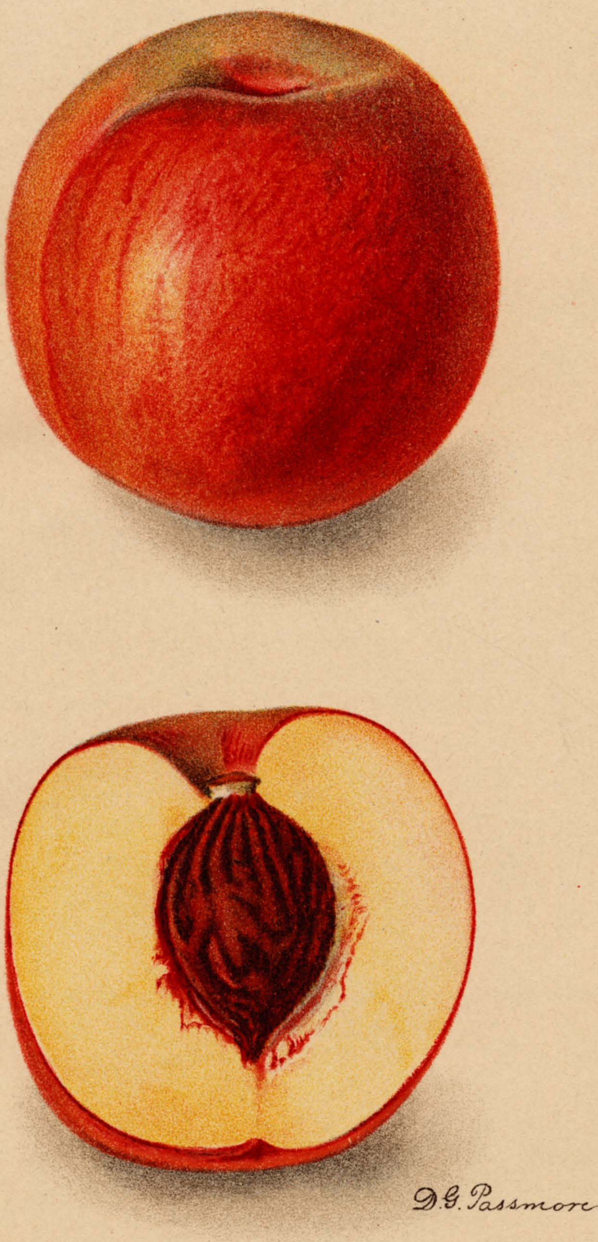
Form conical; size large; cavity regular, large, deep, slope gradual, marked with slight furrows; suture of medium depth at cavity, becoming more shallow toward and extending to the apex; apex a russet dot at end of suture; surface smooth or slightly undulating, sometimes with small areas of russet; color yellow, blushed and marbled over nearly entire surface with dark purplish red; dots very numerous, very small, russet; bloom bluish white; skin medium thick, tenacious, slightly bitter; flesh yellowish, translucent, meaty, half tender, juicy; stone roundish oval, cling, very small; flavor subacid, pleasant; quality very good. Season from about the 10th of June to the end of that month, in the locality where it originated.

The tree is a strong, vigorous, upright grower, with rather large rank leaves. It is said to compare favorably with Abundance and Burbank in productiveness, and thus far it has been remarkably resistant to brown-rot and is said to suffer only to a limited extent from the plum curculio. It has exceptionally good keeping qualities after being picked from the tree and is regarded as a good shipping variety.

The characteristics of this variety, both in tree and fruit, appear to indicate that it is of special promise for southern latitudes. It is

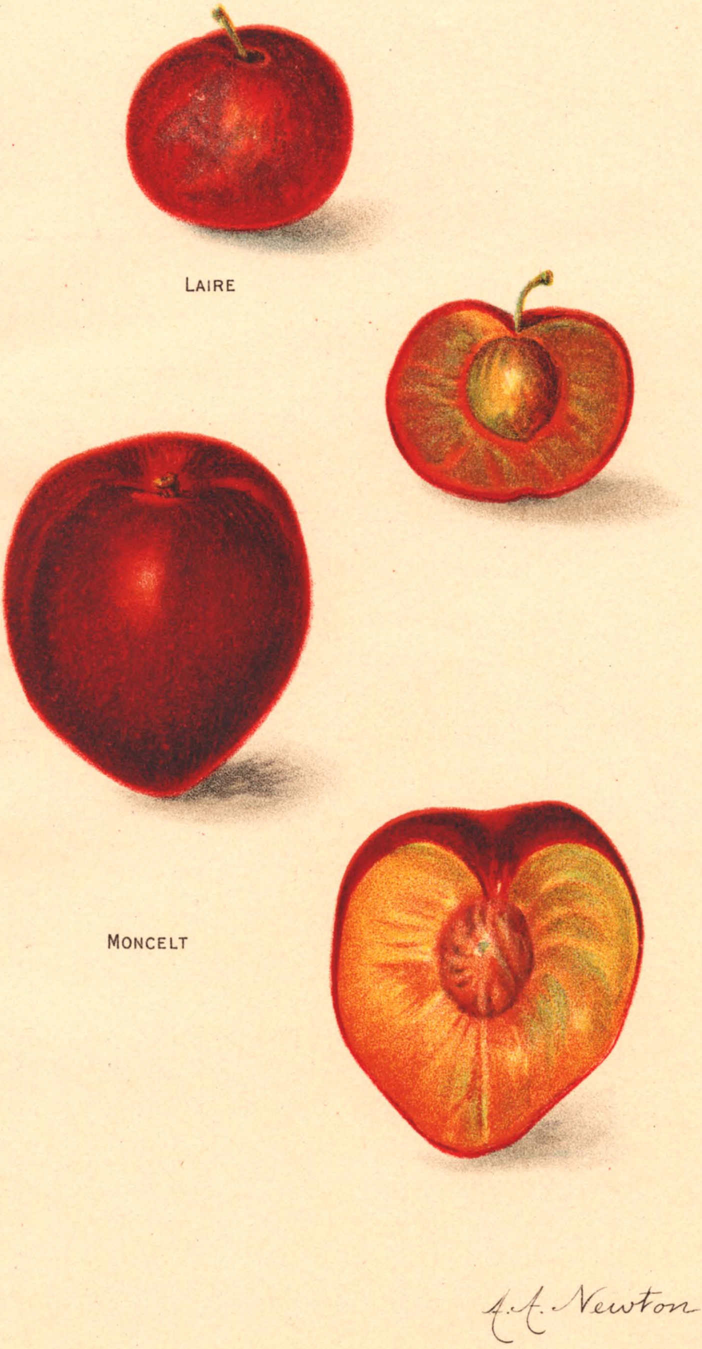
[1] The exact identity of this variety is uncertain. Much confusion existed in the nomenclature of the Japanese plums in the earlier years following their introduction into this country. The name "Red Nagate" was applied to several different varieties, the most important of which is the one now known as Red June. Mr. Bates's tree, while similar in some respects, is said by him to be clearly distinct from Red June.

[2] Letters from Mr. R. Bates, October and November, 1911.



RUSSELL PEACH

HELMS CO. N.Y.

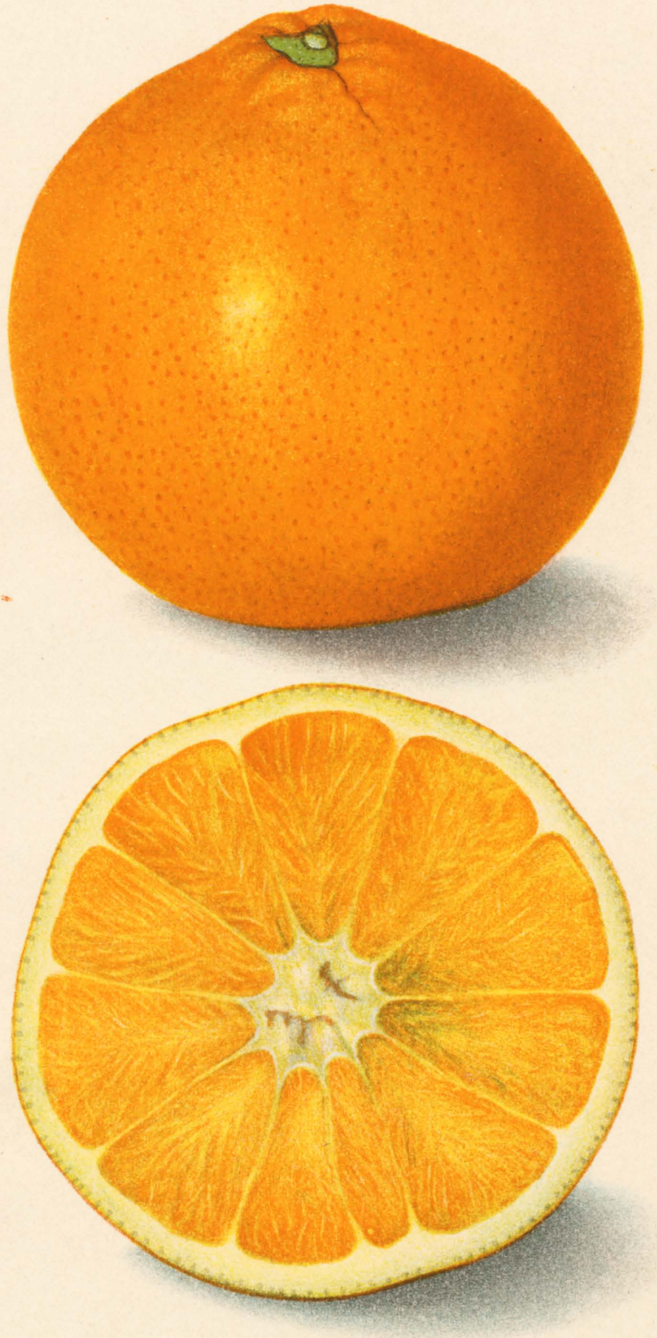


LAIRE AND MONCELT PLUMS

WILHELMS CO. N.Y.

A. HOEN & CO. BALTIMORE.

PANARITI GRAPE



A. A. Newton

A. HOEN & CO. BALTIMORE.

THOMSON ORANGE.

considered worthy of thorough test by those interested in plum growing in the South.

The specimen illustrated in Plate LIV was grown by the originator at Jackson, Aiken County, S. C.

PANARITI GRAPE.

[PLATE LV.]

The Panariti grape is one of the "currant" varieties, the fruit of which when cured constitutes the dried "currants" of commerce. Botanically this group of grapes belongs to *Vitis vinifera*, as do the other European varieties. They are largely grown in Greece and on some of the island possessions of that country, including Cephalonia and Zante. The principal districts on the mainland are in Morea, the ancient Peloponnesus. In these island and mainland districts nearly the entire population is engaged in and dependent on this industry.

The culture of these grapes in Greece has extended over many centuries. According to Eisen,[1] Pliny referred to them as early as 75 A. D. as being grown there, though they appear to have no further historical record for nearly a thousand years. Following the eleventh century, as indicated in Eisen's account, occasional reference is made to them in the old herbals and in other literature of the fourteenth, fifteenth, and sixteenth centuries, under such names as "reysyns de Corauntzs," "Corauntz," "corent," "reysonys of Corawnce," "raysns of Coren," and "currans." By gradual evolution the name "currant" appears to have developed from the name Corinth, the port whence the earlier supplies of this fruit reached western Europe. It appears evident that the name "currant" or "currantes" was applied to this type of grape, at least when dried, as early as 1578.

The common garden currants (*Ribes* species) do not appear to have come into cultivation until toward the close of the sixteenth century. So far as historical records show, the dried fruit of the "currant" grape had then been an article of commerce in some of the European markets for several centuries, so that there seems to be no reason to doubt that the name currant was applied to the genus Ribes because of the resemblance which its racemes of fruit bore to clusters of the "grape of Corinth."

The importance of the currant grape not only to very large numbers of the peasant population of Greece, but to the Government as well, forms an example which is probably without parallel elsewhere in the world. The part taken by the Government in recent years in maintaining the stability of this industry through control of a portion of the crop is equally remarkable.

[1] Eisen, Gustav. The Raisin Industry, 1890, p. 6.

Following the destruction of the vineyards in France by the phylloxera, about 1880 to 1890, there developed in that country a heavy demand for the dried currants of Greece for use in making wines, brandies, etc. This resulted in high prices for the fruit and, consequently, a very large increase in the acreage devoted to grape culture in Greece. In fact, it is stated[1] that the desire to extend currant-grape culture became so great in many instances that large orchards of mature olive trees were sacrificed to this end, as well as many mulberry trees that had been grown to furnish food for silkworms. Thus, in some regions grape culture became the sole industry.

The introduction into France of grape stocks from the United States which were resistant to phylloxera and the rehabilitation of the grape industry, followed by the imposing in 1896 of import taxes which practically excluded the currant grapes of Greece from France, caused a great crisis in this industry in Greece. Large regions were dependent upon grape culture as a means of support. With the French markets, which had previously taken great quantities of currants, virtually closed, the production was far in excess of the demand.

At this juncture the Greek Parliament passed, in 1895, the "parakratesis" or "retention" act, the object of which was to so control the output of currants each year as to prevent, so far as possible, overstocking the markets, and thus to maintain satisfactory prices.

In its operation this law imposes upon every producer a tax of 15 per cent of the product which he exports, payable either in money or by depositing in Government warehouses the required quantity of currants. Thus, only 85 per cent of the crop of any one year, or its equivalent in value so far as the producer is concerned, can be put upon the market. The currants received by the Government must be used for other purposes than those to which this commodity is usually put.

In connection with the passing of the "retention act" the matter of establishing a "currant bank" of Greece was much agitated, the object in view being to provide a source from which every producer who deposits a certain quantity of currants in a Government depot or warehouse should be entitled to draw money from the bank, or to hypothecate his crop. Such a bank, however, was not established until 1899, when with the Government proceeds from the sale of currants to distillers, etc., it was formed with a capital of 3,500,000 drachmas (about $675,500).

The currant has long been the leading commodity of export from Greece. The tax of 15 per cent of the crop exported forms one of the principal sources of revenue for the Government; at the same

[1] Horton, George. The Currant Trade of Greece. United States Consular Reports, vol. 50, pp. 243–245.

time the diverting of that proportion of the crop each year from the ordinary channels of commerce doubtless has, in some seasons at least, a material effect upon the market price received for the exported product.

Currant grapes were apparently introduced into some of the Vinifera districts of California as early as 1861,[1] but they have not yet attained commercial importance there. Imports into the United States in 1910 totaled more than 33,000,000 pounds of currants, having an approximate value of $1,178,750. The imports of currants during that year from all other countries were less than 250,000 pounds.[2]

EARLY HISTORY OF THE PANARITI GRAPE IN THE UNITED STATES.

The history of the Panariti grape in the United States dates from the receipt from Panariti, Greece, through Mr. David Fairchild, agricultural explorer of this department, of a shipment of cuttings which reached Washington May 9, 1901. Concerning this grape Mr. Fairchild states:[3]

> The variety of grapes producing the *currants* or *corinths* of commerce. These cuttings were purchased in the village of Panariti, which lies among the mountains back of Xyloncastron. This village is noted for producing some of the finest corinths in Greece.

Several varieties of currant grapes are grown in Greece, though the crop differences are not distinguished in that country by varietal names, but by the name of the regions in which they are produced; thus, Panariti grapes are grapes grown in the vicinity of the village of Panariti.

Soon after the importation of cuttings was received at the department they were distributed among grape growers in representative Vinifera grape-growing districts in California, Arizona, and southern Nevada. More recently the variety has been more widely disseminated in connection with the viticultural investigations of the Bureau of Plant Industry.

DESCRIPTION.[4]

Bunch very long, almost cylindrical but tapering, with quite an enlargement toward end of bunch, often shouldered, straggling, loose; stem $1\frac{1}{2}$ to 2 inches long, of medium size, soft and fleshy; berry round, very small, not averaging much over one-fourth of an inch in diameter; surface smooth; color amber with whitish bloom; skin rather

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[1] Eisen, Gustav. The Raisin Industry, 1890, p. 38.

[2] Bulletin 90, Bureau of Statistics, entitled "Imports of Farm and Forest Products, 1908–1910," p. 42.

[3] Bulletin 66, Bureau of Plant Industry, entitled "Seeds and Plants Imported during the Period from September, 1900, to December, 1903, Inventory No. 10," p. 84, No. 6429.

[4] Description furnished by Mr. George C. Husmann, Pomologist in Charge of Viticultural Investigations, Bureau of Plant Industry.

thin; flesh white, soft, fairly juicy; flavor sweet with the characteristic flavor strongly developed. Season early August at Fresno. Its chief value will doubtless be for drying. Wood light brownish green, somewhat striped, with internodes 3 to 4 inches in length; rather slender. In the first crop, which is the only one of real value, the berries are seedless, but the second and third crop grapes contain some seeds.

The question of the most suitable resistant stocks for this grape, as well as the methods of pruning, training, and other cultural operations, is being investigated at the cooperative experiment vineyard maintained by the Bureau of Plant Industry at Fresno, Cal. Indications at present suggest that the matter of stocks may be of much importance.

Cultural methods also call for careful consideration in any development of the currant industry that may occur in this country. For instance, in Greece it is a common though not universal practice to girdle the vines to increase productiveness. It is understood that in Australia girdling is the usual practice, as light crops are habitual unless this is done. Whether this method or some modified form of it can be effectively or advantageously adopted in this country is as yet undetermined.

The adaptability of this variety to successful culture, in at least some of the Vinifera grape districts of California, appears to have been demonstrated. Some of the grape growers are already becoming interested in it and it seems probable that in the near future the production of it will become of considerable commercial importance in the Vinifera grape districts in this country.

Ripening early, as it does, before most other varieties mature, the fruit can be handled advantageously with the same vineyard crews that are required later for harvesting the wine and table grapes. As the ripening time in California is during the rainless period, when the climatic conditions are the most favorable for drying the fruit, there is everything to encourage its planting by those desirous of producing currants.

The cluster illustrated in Plate LV was grown at the cooperative experiment vineyard, Fresno, Fresno County, Cal.

THOMSON ORANGE.

SYNONYMS: *Thomson's Navel, Thomson's Improved Navel, Thompson, Thompson Improved, Thompson's Improved Navel.*

[PLATE LVI.]

One of the remarkable features of the orange industry of California is the fact that it has been built up so largely on a single variety, the Washington Navel[1] or "Bahia," which was introduced into that

[1] For a concise history of this variety, see Bulletin 123, Bureau of Plant Industry, entitled "The Decay of Oranges while in Transit from California," p. 9.

State from Brazil by the United States Department of Agriculture less than 40 years ago. The shipments of oranges from California for the crop year 1910–11 amounted approximately to 39,500 cars. Of these three-fourths are estimated to have been of the Washington Navel variety.

In view of the large production of this variety and the high esteem in which it has been held for 30 years or more, it appears strange that no seedlings of it have yet attained the distinction of commercial introduction in our orange districts. This is doubtless in large part due to the rarity of seeds in its fruit when grown under ordinary orchard conditions. In recent years there have appeared in the California orange districts several well-authenticated bud sports or variations, one or two of which have been planted commercially to some extent, the Golden Buckeye being an example.

Of less certain origin but more important commercially than the above-named variety is the Thomson, which was disseminated by the late A. C. Thomson, of Duarte, Los Angeles County, Cal., about 1891.[1] The published accounts of the origin of the variety are conflicting. The first statement[2] was to the effect that it was an improvement on the Washington Navel accomplished by budding that variety on a St. Michael stock, then budding from this tree on a Mediterranean Sweet stock, thus securing the cumulative effect of the two stocks upon the Washington Navel. The statement was received with much incredulity by the horticultural public and three years later the introducer published in the Pacific Rural Press[3] an account in which it was implied that the variety was produced by "split-bud" propagation but without details as to what varieties had been used as the parents. At the same time he submitted to the editor specimen buds prepared to illustrate the method which he had described.

The inadequacy of the evidence submitted and the well-known tendency of the Washington Navel orange to produce bud sports has resulted in a firm conviction in the minds of many orange growers that the Thomson in fact originated as a bud sport rather than through any special process or expert manipulation of buds.

The exceptional beauty and attractiveness of the fruit aroused much interest among growers, which was accentuated by the award of a first premium to the variety when it was exhibited at the Columbian Exposition in Chicago in 1893. Considerable plantings of it are now found throughout southern California and some in other orange-growing sections. As a dessert fruit it is not equal to the parent variety, lacking in juiciness and sprightliness of flavor.

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[1] California Fruit Grower and Fruit Trade Review, vol. 8, No. 14, Apr. 4, 1891, p. 211, and No. 19, May 9, 1891, p. 290.

[2] Azusa Pomotropic, Mar. 19, 1891, p. 7.

[3] Pacific Rural Press, vol. 47, no. 23, June 9, 1894, p. 433.

DESCRIPTION.

Form slightly oblong; size above medium to large; cavity small, furrowed; apex, navel markings either small or quite prominent; surface smooth or slightly undulating; sometimes very shallow, longitudinal furrows; stem slender; color pale orange yellow, reddening somewhat after picking, but usually not as richly colored as the Washington Navel; oil cells numerous, small, indented or even with surface; rind relatively smooth, rather closely adherent, usually thin and rather tender; segments 10 to 12, irregular in size with open center; flesh, rich yellow to deep orange in color, translucent, moderately tender; cells small, regular, enveloping tissue thin; juice translucent, not very abundant; seedless; flavor sweet, sprightly, pleasant; quality good, but not equal to the Washington Navel when the latter is well grown. Its shipping season is about the same as that of the Washington Navel, but it reaches full maturity about one month earlier than that variety. The satiny surface and bright color give the variety special popularity for certain trade in the large cities, where appearance rather than quality determines demand and value. The tree characteristics of the Thomson are quite similar to the Washington Navel. It is reported by Shamel[1] to be quite subject to "sporting," numerous branches on Thomson trees yielding fairly typical Washington Navel fruits. It is reported to succeed well in Arizona and has recently been reported[2] as doing well in Algeria under conditions to which the Washington Navel orange does not appear to be well adapted.

The specimen illustrated in Plate LVI was grown at Riverside, Cal.

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[1] Letter from Mr. A. D. Shamel, February, 1912.
[2] Letter from Mr. Walter T. Swingle, December, 1911.

GREEN VEGETABLES AND THEIR USES IN THE DIET.

By C. F. Langworthy,
Chief of Nutrition Investigations, Office of Experiment Stations.

INTRODUCTION.

One of the marked differences between the daily fare to-day and that of 50 years ago consists in the increased supply of green and succulent vegetables, a class of food used, as their name implies, for their refreshing and palatable qualities more than for their total nutritive value. Not many years ago the winter's supply of vegetables in all except southern countries was limited to root crops and a few other staples, such as onions and cabbage, which could be kept in the cellar in comparatively good condition. New and improved varieties, better methods of cultivation, improvements in transportation and storage, the great development of market gardening under glass, and the development of the canning and preserving industry have made succulent vegetables common throughout the year and available in one form or another for almost every family.

This group of vegetable foods is varied in character, including leaves, stems, and stalks, potherbs and seed pods, and many fruits, or, in general, those parts of plants in which water is abundant rather than those like the seed or the starchy root in which the plant has laid by a compact store of nutritive material for its future use, or which, like the shells of fruits, cornstalks, and the trunks of trees, have passed the active growing stage and become rigid by the thickening and toughening of the walls of the plant cells.

ORIGIN OF GARDEN VEGETABLES.

As regards their original habitat, common succulent vegetables represent nearly all quarters of the globe. Although a number of them have been used for centuries as human food, the majority have come into common use within comparatively few years.

Okra, a vegetable long known to gardeners, is stated to be a native of Africa and was cultivated more than a thousand years ago. Asparagus also has been known for centuries. Rhubarb was introduced into western Europe as early as the tenth century, while tomatoes and some of the squashes, as well as potatoes, Indian corn, and some types of beans, are of American origin and found their way into Europe not long after the discovery of this country. Tomatoes slowly gained recognition for table purposes, having long been grown as ornamental plants only. Indeed, their general use as vegetables dates back hardly more than a generation or two. It is perhaps needless to say that attributing cancer to the use of tomatoes, as was formerly done, is, like most such ideas, regarded as without foundation.

New Zealand spinach, udo, dasheen, and others might be mentioned as rather recent introductions. The Department of Agriculture has always endeavored to secure new varieties and new and promising food and forage plants from different parts of the world, and has added much of great value to the list of farm crops and garden plants. As garden vegetables have been adapted to new conditions, either by centuries of cultivation or more quickly by the plant breeder, appearance and original characteristics have been modified and often greatly changed, and new and improved varieties especially adapted for table use have been developed.

In general, it may be said that although many wild plants are used as potherbs and in similar ways, by far the greater proportion of this class of foods comes from farm and garden, as is the case with other groups of food plants. In other words, man has found it desirable to control his food supply by cultivation rather than to depend upon the uncertain natural supply, though he still uses the natural supply in a limited way to supplement the cultivated products, often prizing the wild plant or fruit because of some special quality or delicate or unusual flavor.

CLASSIFICATION OF GREEN AND SUCCULENT VEGETABLES.

If the green succulent plants used as vegetables are classified according to the parts used they fall into such groups as (*a*) leaves, stalks, stems, and leafy heads, of which spinach, celery, asparagus, and cabbage, respectively, may serve as examples; (*b*) flower heads and flowers and a number of fruits; and (*c*) seed pods and seed vessls, as string beans, okra, and green peppers. (See fig. 14.)

Besides the well-known use of leaves like lettuce and spinach for salads and potherbs, there are others which are of some interest because they are unusual. Thus, grapevine leaves, which find little use in the United States except for covering pickles, to which they are supposed to impart a green color, are commonly used in Turkey for making a number of dishes. For instance, little rolls of highly seasoned forcemeat wrapped in grape leaves and cooked until tender are a characteristic dish at wedding feasts. In the southern United States tender sassafras leaves, dried and ground, are used like okra

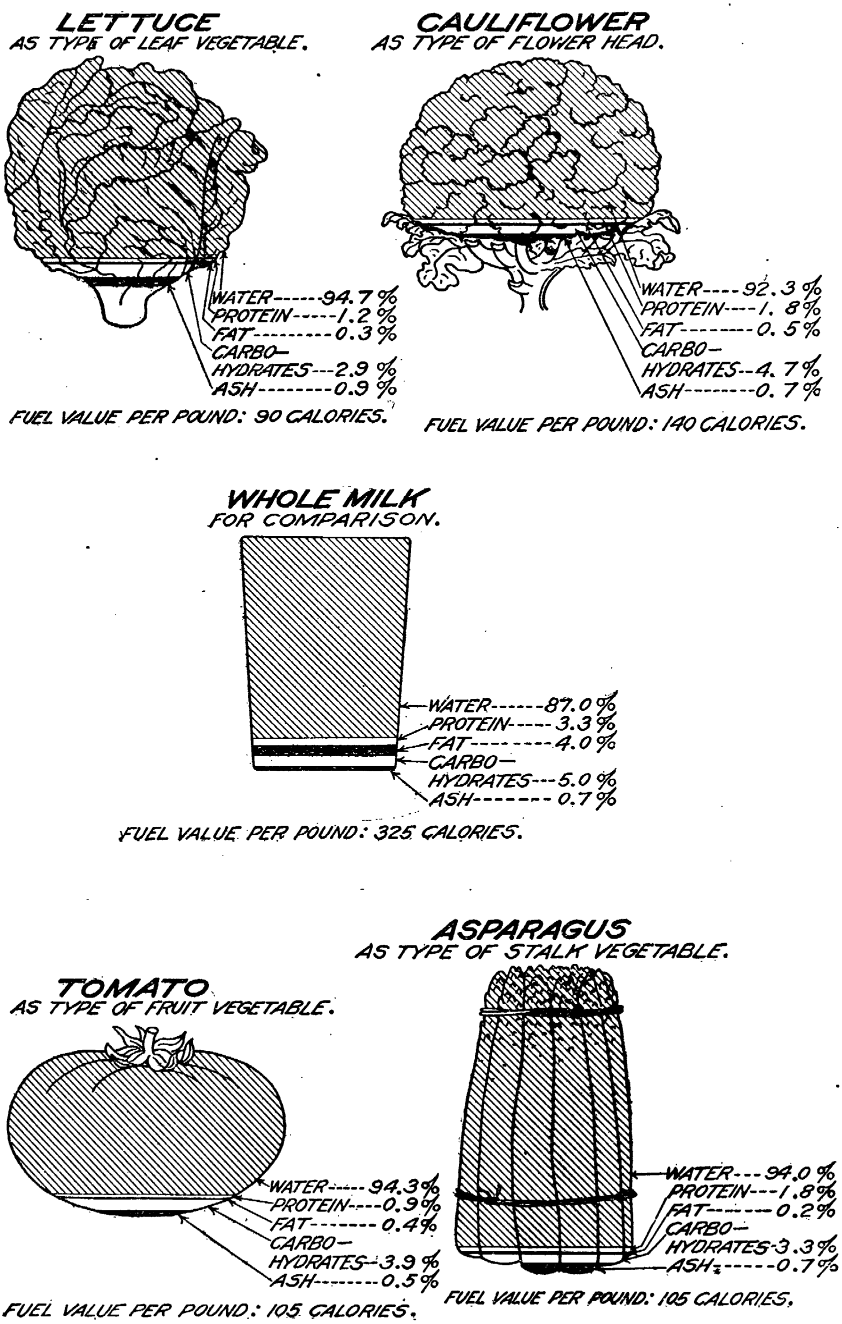


FIG. 14.—Composition of some succulent vegetables as compared with milk.

or gumbo to thicken soups, and many other field and garden plants are occasionally used to impart flavor or color or in some similar way.

Under flower heads may be grouped such vegetables as cauliflower and globe artichokes, which are common vegetables. Rhubarb flower heads, though seldom eaten in America, are sometimes cooked when well developed, but before they have begun to unfold. Flowers find little use as foods in the United States, though a number of sorts are of considerable importance in the tropics. Nasturtium blossoms, like the leaves and tender stems of this plant, are now and then added to salad or used in similar ways. Unopened squash blossoms, which are used for making fritters in Italy, are also used in a limited way in the United States, as are elder blossoms, this usage coming to us from Germany. The unopened buds of marsh marigold, dandelion, and many other flowers are cooked with the leaves as potherbs, and the green unopened buds of capers, pickled, are used as seasoning.

If succulent vegetables are grouped according to their uses, some such division as the following would result: (*a*) Salad plants which are eaten uncooked either with or without dressing; (*b*) potherbs or "greens;" (*c*) vegetables used chiefly for flavoring, either raw or cooked; (*d*) succulent vegetables or fruits which are cooked and used in making a variety of dishes; and (*e*) leaves for making table beverages.

Of salad plants the most common is lettuce, ranging in its different varieties from flat, open leaves to close leaf heads like a cabbage in form. Other common salad plants are chicory in several varieties, cress, and celery. Salad plants, as the name implies, may be eaten with salt alone, but are more commonly mixed with salad dressings made of oil or other fat, as cream, and acid, as vinegar or lemon juice. There are a number of wild plants used as salad; for instance, young dandelion leaves, peppergrass, and water cress.

Just as lettuce may be called the typical salad plant, so spinach may be called the typical potherb. Other well-known garden plants used like the latter are cabbage and cabbage sprouts, Savoy cabbage, Chinese cabbage, kale, collards, turnip tops, beet tops, chard, mustard, and the leaves of dasheen, which, though of recent introduction, is coming to be an important food plant in the United States. Other vegetables similar to potherbs in the way they are used, though perhaps not commonly so classed, are asparagus, a variety of fennel, hop sprouts (well known in Belgium and France, though little known in the United States), and bamboo shoots, much used in the Orient, and which canned are not uncommon in American cities and towns where Chinese foods are on sale. Many wild plants are used as potherbs, including, among others, dandelion, yellow dock, pigweed, chickweed, mustard shoots, marsh marigold (sometimes called American cow-slip), purslane or "pusley," and cactus leaves and stalks, which are used in southwestern United States and more commonly in Mexico, while such things as poke sprouts and young milkweed shoots are used like asparagus. Tender blackberry shoots are used in the same way, as are also the tender sprouts of brakes or other ferns, such usage being very rare in the United States, though fairly common in Japan. Other green vegetables which resemble potherbs in that they are very commonly prepared for the table by cooking them in water until tender are green peas, green cowpeas, tender beans of different varieties, edible podded peas, snap beans, tender green cowpea or field-pea pods, and green corn, a vegetable which is distinctly American and perhaps more generally liked in the United States than any other green vegetable.

As regards leaves and plants used for seasoning, perhaps the most common in the United States are onion tops, celery leaves, chives, and parsley, which, as everyone knows, is also a particular favorite as a garnish. Wild garlic leaves are sometimes used, as is borage, which has a flavor like that of cucumber. The thrifty housewife often dries parsley and celery leaves for winter use. Of wild plants, aromatic wintergreen and princess pine have been used in a limited way in times past, but are now almost forgotten for home use, except as they are gathered by children.

Dried leaves of seasoning herbs, as sage, summer savory, thyme, and bay leaf, are used in most homes, though perhaps less commonly than was once the case. Such seasonings should be used judiciously, as a delicate rather than a strong flavor is what is desired.

Some of the fruits used as succulent vegetables, for instance squash and eggplant, are seldom eaten raw; others like cucumbers are more commonly used raw than cooked; while others like tomatoes and green peppers are very commonly used both raw and cooked and in a great variety of ways.

The use of leaves for making beverages is a very ancient one and it would be difficult to hazard a guess as to the time when tea leaves were first gathered for this purpose. It is a common opinion that the curing of tea leaves is little more than a drying process, but this is not the case, since the chief object is to secure a specific kind of fermentation which develops aroma and flavor. Variations in curing and handling the tea leaves are very largely responsible for the flavors of different brands. A plant which is perhaps next to tea in importance, in this connection, is Paraguay tea, or maté, which finds such extensive use in South American countries.

Numerous wild plants are sometimes used as substitutes when tea can not be procured. The early settlers in the United States used a number of these wild plants and leaves, such as New Jersey tea, snowberry (which Thoreau regarded as an agreeable substitute for black tea), and sweet fern, which was known in colonial times as "mountain tea."

COLOR OF VEGETABLES.

Green vegetables, like lettuce and other leaves, owe their color to chlorophyll, the green coloring matter of plants, which plays an important part in their growth. When plants are blanched the green undergoes changes and disappears, the plant becoming yellowish and finally white, as in blanched celery. The purple and red leaves of some cabbages and beets owe their color to other compounds somewhat like chlorophyll, present with it or in place of it. The case is much the same with the red, yellow, or other color of fruits used as vegetables, the coloring matter being something which the plant builds up as a part of its life processes.

The coloring matter of leaves, flowers, and plants is often squeezed out or extracted and used in cookery. Thus, spinach yields green, the saffron of Europe yellow, and violets their characteristic color.

FLAVOR OF SUCCULENT VEGETABLES.

Green and succulent vegetables owe their flavors, as do other vegetable foods and fruits, to the presence of citric acid and other acids and their salts, to sugars, to specific compounds such as essential oils, and to bitter substances or other complex chemical compounds, most of them in solution in the plant juices. Tannin, which is present in many unripe fruits, causes an astringent or puckery taste which commonly disappears or becomes milder as the plant ripens.

Not infrequently a family of plants is characterized by the presence of chemical bodies of the same or similar flavor; thus cabbage, kale, cauliflower, mustard, and other cruciferous plants contain sulphur compounds of pronounced flavor. The same may be said of chives, onions, leeks, and related plants. In celery the characteristic flavor is attributable to the presence of a volatile oil-like substance.

The green succulent vegetables which are used for salads and as potherbs and in similar ways could be grouped according to their flavor. Most of them are bland in flavor, as spinach; some are more or less bitter, as chicory and dandelion; while others are sharp, as cress and peppergrass; sour, as is sorrel; or aromatic, as mint and spearmint. Those of bitter flavor are usually made milder by cooking.

It is self-evident that it is the possession in abundance of characteristic flavor which makes such green vegetables as chives and celery leaves prized for seasoning. Many blossoms are also prized for this quality—for instance, rose petals, orange blossoms, and violets.

QUALITY AND FACTORS WHICH INFLUENCE IT.

The stage of growth at which leaves, stalks, and similar potherbs and salad plants are best for the table depends mainly upon two things—the condition of the cellulose which makes up the framework of the plant and the presence of the chemical compounds which determine flavor. A certain amount of cellulose is desirable in food; but if a plant has become too old and tough, the digestive juices do not so readily reach the nutritive materials inside the plant cells, and, furthermore, such cellulose, if too abundant, is believed to be a cause of intestinal disturbances. Then, too, the flavoring bodies frequently become so plentiful in older plants that they are too bitter or too acrid to be acceptable. Leaves and stems are usually best when young. The cellulose is then tender and the flavor delicate.

Blanching—that is, covering all or part of the plant in such a way as to exclude light for a time—is a device by which the plant is encouraged to develop size without toughness and become milder flavored by lessening the chlorophyll and also flavor bodies which are present apparently in the chlorophyll cells. In the case of white asparagus, which some persons insist is better than the green, the shoots grow up through a deep layer of soil or mulch, and as they reach the surface are cut near the root with a special knife. The flavor of asparagus which is grown above the ground is different from that of the blanched asparagus and to many palates seems to possess more of the delicate flavor suggestive of green peas.

With some of the fruits which are used as vegetables conditions are frequently the reverse of those observed with leaves and stems, the cellulose in the immature fruit being hard and tough and the flavor too sour, owing either to an abundance of acid or lack of sugar, or too astringent, owing to the presence of tannin. Such immature fruits may be injurious as well as disagreeable in flavor.

As fruits of certain types ripen the cellulose softens and the flavor increases, sweeter and more palatable compounds replacing or masking the flavors which predominated in the unripe fruit. Thus, tomatoes find their principal uses when fully ripe. Other fruits used as vegetables grow coarser as they ripen; for instance, cucumbers and turban squash, which are considered best while young and crisp.

Freshness is almost as important an element in table quality of vegetables as is tenderness. The leaves, stalks, fruits, etc., when gathered for the table are still living things and the ferments in their tissues which are concerned in their ripening processes are still active and may continue so for a long time. The loss in sweetness after gathering, the deterioration in flavor, and similar changes are without doubt attributable to the action of these ferments, which cause a loss of the plant sugar, or modify the flavor in some other way.

The wilting of vegetables is due to a loss of water by evaporation, and, as everyone knows, it may often be prevented by keeping the leaves, stalks, etc., moist, while those which are already wilted may be freshened chiefly in appearance by putting them in water. Variations in the botanical structure of the surface and other parts are responsible for the differences which green vegetables show in this respect, those characterized by a more impervious surface keeping unwilted longer than those with opposite characteristics.

Wilting and other undesirable changes are less pronounced at a low than at a high temperature, and this fact is taken advantage of when the housewife keeps her fresh vegetables in good condition in the refrigerator and when the dealer holds them in the cold-storage warehouse. The fact that the plant continues to live for a time and carry on its life processes after picking explains why it is that vegetables or fruits picked underripe reach market in a ripened condition when shipped long distances or kept for a time in cold storage.

Withered or badly wilted vegetables or those which have lost their fresh color and become yellowish or brown should be avoided, as they have undoubtedly lost flavor and quality. Those which have begun to decompose should be rejected, particularly if they are to eaten raw, as the molds, bacteria, etc., which have found lodging on or in the plants and developed may be in themselves a cause of illness or may be accompanied by other microorganisms which will have such an effect. Cleanliness in handling, marketing, storing, and preparing food for the table is, in all cases, very important, but is particularly needed in the case of various green vegetables or any other foods which are eaten without cooking. Such vegetables should always be looked over carefully, all bits of foreign substances removed, and then carefully washed in a number of waters. The hasty rinsing under the spigot which too often serves the purpose with lettuce leaves seldom frees them from sand and is less likely to remove other undesirable material if present.

Most salad plants and similar vegetables grow near the surface of the ground, and it is not surprising that they should be accidentally contaminated with earth, etc. Furthermore, like all green plants, they are subject to insect attacks and may be the lodging place of insects and insect eggs. Sometimes vegetables are dangerous owing to the fact that the soil has been fertilized with improper material; or in the case of such a vegetable as water cress, because it has been grown in contaminated water. If possible, vegetables which are to be eaten raw should be selected which are known to have been grown and marketed under good conditions.

Many plants are handled in market under such conditions that they are exposed to street dust, dirt, and other possibilities of contamination. That such contamination, when it exists, is actually dangerous as well as disagreeable is evident from the results of examination, which show that vegetables or foods exposed to street dust or those handled in an improper manner are commonly contaminated with micro-organisms, very often including those which may cause typhoid fever or the intestinal disturbances so common in summer. The safest course for the housewife is to purchase her supplies, particularly those which are used without cooking, from dealers whose goods are handled in a cleanly way. Under all circumstances the foods to be eaten raw, as has been said, should be thoroughly washed in a number of waters, so that any dirt, dust, or other impurity on the surface may be removed.

Heat, as everyone knows, is a sterilizing agent, and thorough cooking will destroy bacteria if they are accidentally present. Nevertheless, the housewife who is at all fastidious will not dispense with washing vegetables or other foods, even if they are to be cooked.

FOOD VALUE OF SUCCULENT VEGETABLES.

Many of the succulent vegetables, in spite of their solid appearance, contain a larger proportion of water than does milk. Their value in the diet, therefore, and they have a decided value, lies not in any large quantity of nutrients, but in small quantities of special materials which they provide and the bulk which they give the diet, and also in their appetizing qualities, their flavor and appearance, and the variety which they make possible.

The amounts of protein (or nitrogenous material), fat, and carbohydrates (sugars, starch, and cellulose) contained in succulent vegetables are much smaller than in staple foods such as bread, meat, and cheese. In general, it may be said that from 85 to 95 per cent of the weight is made up of water, 1 to 2 per cent of protein, less than 1 per cent of fat, 5 to 10 per cent of carbohydrates, and less than 1 per cent to 2 or 3 per cent of mineral matter. Their fuel value is correspondingly low, ranging from about 80 to some 300 or 350 calories per pound. The figures on page 441 show graphically the composition of succulent vegetables of different types in comparison with a liquid food, milk.

The mineral matter or ash which is found in vegetable foods, like that in other foodstuffs, is varied in character, potassium, iron, phosphorus, sulphur, and other mineral elements being present, some of them in combination with citric acid or other organic acids. The proportion of some of the mineral substances which the body requires is more abundant in fruits and succulent vegetables than in most other sorts of food; and if for any reason the body lacks these foods for a long time, disease may result. It is well known that scurvy, which was so common on old sailing vessels, where the diet was usually made up very largely of bread and salt meats, was prevented or relieved by the addition of an abundance of green vegetables, potatoes, or other fresh foods to the diet.

The form in which mineral matter occurs in foodstuffs has a decided bearing upon the use to which the body can make of it, and it seems certain that mineral matter occurs in satisfactory combination in green vegetables and similar foods. It is commonly said that spinach contains a relatively high percentage of iron and that this is one reason why it is a valuable article of diet. Carefully conducted experiments as to the source of iron in the diet, undertaken as a part of the nutrition investigations of the Office of Experiment Stations, indicate that such is the case and that the proportion of iron and other ash constituents in the diet can readily be increased by the use of an abundance of such vegetable foods.

To insure the normal and regular passage of the food through the lower part of the digestive tract a certain amount of indigestible but nonirritating material seems desirable, and this is provided by such substances as the cellulose which forms the framework of vegetables. Some solutions of mineral salts have the property of hastening the passage of food through the intestines, and it seems very probable the succulent vegetables owe their well-known laxative properties in part at least to the specific nature of their juices, which are, of course, a solution of small amounts of mineral matter, plant acids, soluble nitrogenous matter, sugars, etc., in water.

As regards the completeness with which the nutritive elements present in green vegetables are assimilated, little experimental evidence is available. It would seem safe to say, however, that they are fairly well assimilated, 70 per cent of the protein, over 90 per cent of the total carbohydrates, and over 80 per cent of the crude fiber present being retained in the body. Similar values for the digestibility of total carbohydrates and crude fiber apply also to some dried vegetables. Regarding the ease of digestion, much apparently depends upon the condition of the vegetable when it is eaten. If its cellulose is too abundant, or fibrous, old, or tough, vegetables may prove irritating to persons with a delicate digestion. Immature or overripe vegetables, particularly if eaten raw, may also cause digestive disturbances, perhaps more often ascribable to bacteria accidentally present than to chemical constituents. It is safe to say that with persons in good health, with ordinary digestive powers, vegetables in good condition do not cause digestive disturbances, but, on the contrary, more often exercise a favorable influence.

Green vegetables are very abundant in the United States and, in season, are comparatively inexpensive. It would seem that their use is more common in this country in families of all circumstances than is the case in some other countries, and this is surely an advantage.

Popular statements are numerous to the effect that this or that vegetable is indigestible, or that some particular kind is very nutritious or is possessed of some special virtues; yet there is very little accurate evidence on which to base such assertions, and, generally speaking, they can be traced to beliefs of earlier times.

The medieval herbals are full of curious statements regarding the curative or other marvelous properties of various plants, and not more than a century ago the capable housewife reckoned a knowledge of their medicinal virtues among her useful accomplishments. It is true that some green plants used as food—for instance, dandelions, dock, or chicory—contain bitter principles or other substances which have been used in medicine, and that the milky juice of lettuce contains constituents with physiologically active qualities. However, when due allowance is made for all such facts, it is still true that for most healthy persons the benefits which come from eating green vegetables in abundance are due to their general qualities and not to specific medicinal virtues which some of them may possibly possess in small degree. It seems more than probable that such tonic virtues as those attributed to some of the green plants used as spring medicine were really ascribable to the fact that they were a very welcome addition to the winter fare and made the food more appetizing.

PREPARING GREEN VEGETABLES FOR THE TABLE.

The methods followed in preparing vegetables for the table are numerous, though, as is often the case in cooking, many of the dishes differ in detail rather than in principles followed. Most of the numerous recipes which are found in books and other publications devoted to cookery come from the housewife's experience or the expert cook's attempt to present materials in an appetizing form.

Knowledge of the changes which cooking produces in food materials is usually drawn from three sources—common household experience, the accurate observation of processes necessary in establishments where food is prepared on a commercial scale, and the experiments made for more theoretical purposes in research laboratories. In the case of succulent vegetables much less definite information has come from the second source than with such materials as bread, cracker, and other cereal preparations, probably because the succulent vegetables are not prepared on a large scale, except in the canning industry. As regards the third source, information is limited for all classes of foods, since the chemistry of cookery has not as yet received the attention it merits.

Very few of the problems of vegetable cookery have, in fact, been carefully studied by laboratory methods. References are occasionally found in chemical literature to the presence of sulphur compounds in the steam from cooking vegetables such as cabbage and a great variety of others, to the changes which carbohydrates and other food constituents undergo when cooked with moist and with dry heat, and to similar matters, but apparently few systematic studies of the cooking problem have been undertaken from such a standpoint. It is undoubtedly true that much that is of interest as well as of value will be learned when the chemist turns his attention to work of this kind.

Some of the nutritive material present in green vegetables may escape into the water in which they are cooked, and if the water is discarded this means a corresponding loss. In experiments made in connection with the nutrition investigations of the Office of Experiment Stations it was found that when cabbage, which contains 7½ pounds of dry matter per 100 pounds of fresh, green substance, was cooked in water, one-half of the mineral matter and over one-third each of the carbohydrates and nitrogenous material present in the dry matter were dissolved out. Such a loss seems inevitable with boiled cabbage, etc., unless the green vegetable is cooked in such a manner that the water in which it is boiled is also used. This is frequently the case with cabbage when it is cooked with corned beef or ham or in some similar way, or when such green vegetables as spinach are cooked in so little water that there is only a small quantity, if any, to drain off before serving. Recent French experiments made with cabbage, asparagus, and other succulent vegetables showed that, on an average, 30 per cent of the total mineral matter was extracted when the vegetables were cooked in water for 20 minutes.

On the basis of such facts as the above it has been suggested that green vegetables should always be steamed in their own juices instead of boiling them. If the total amount of such foods we could secure were very limited, or if there were no other foods from which the body could secure mineral matter, the question might be one of greater importance. Under present conditions it seems safe to say that the housewife who provides a varied diet is justified in selecting the manner of preparation which suits the taste of her family.

When potherbs and similar green vegetables are prepared for the table care must be taken that they are not overcooked, as it is commonly conceded that this entails a loss or deterioration of flavor, while it also injures the appearance, the green color turning yellow or brown. So characteristic is this change that the loss of green color may be taken as a measure of the overcooking. Spinach cooked until it is brown, overcooked asparagus, a vegetable whose delicate flavor is very commonly thus spoiled, and tender green beans and green peas cooked so long that they become yellow, no longer possess the delicate and characteristic flavor which makes them so popular. If such vegetables as cabbage and cauliflower are cooked just long enough to make them tender but not long enough to make them brown or yellow, it is believed that they are digested without trouble, while if cooked until they are yellow or brown they too often deserve their reputation as the cause of digestive disturbances. In some cases the length of time which foods are to be cooked seems mainly a matter of preference. Thus, many believe that the tomato is improved in flavor by long cooking; some prefer green corn cooked only long enough to make it tender; while others consider that corn, particularly when cut from the cob, gains an added flavor by long, slow cooking.

Blanching green vegetables during growth in order to make them tender has already been referred to. The same word is sometimes used to describe a cooking process very common in France. The vegetables are cooked in rapidly boiling water and when they are just beginning to get tender are plunged into cold water, chilled, and drained. They may then be prepared for the table immediately by further cooking and seasoning, or they may be kept cold and finished later when needed. Expert cooks believe that blanching improves the quality of the vegetables and, furthermore, that it has a decided advantage in that the preliminary cooking of such vegetables as cauliflower can be done whenever convenient, and the cooking completed in a few minutes, just before the vegetable is served

CANNING AND PRESERVING VEGETABLES.

The problem of preserving green vegetables is fundamentally the same as in the case of fruits or other food materials, namely, to destroy any micro-organisms causing fermentation or decay which may be present, to hinder or prevent the subsequent entrance of such micro-organisms, and to accomplish this without producing undesirable changes in the flavor and appearance of the food. Green vegetables are commonly preserved either by drying or evaporating them until there is so little moisture left that the micro-organisms can not survive or grow, or by sterilizing the materials by heat and preventing the entrance of micro-organisms, as in canning.

Many housekeepers have long been in the habit of "putting up" vegetables for family use, and nowadays canning on a large scale for sale is growing in importance as a home industry, not only on farms, but anywhere that a cheap supply of fresh vegetables can be obtained. When canning is done on a considerable scale, even in private houses, regular canning outfits often replace the old household appliances. As everyone knows, the commercial canning of vegetables has developed in half a century into a very important enterprise. Canned vegetables keep well and when of good quality are wholesome and palatable additions to the diet. Since they have been cooked during the process of manufacture, they may be quickly prepared for use.

Drying was a common domestic process in the days before the canning industry was developed, but gradually fell into disuse because the old methods as used with vegetables did not produce a very satisfactory result. In recent years improvements have been introduced by which water is removed rapidly and at a temperature which does not destroy flavor, and dried and desiccated vegetables are now common commercial products. When slowly soaked until they regain the quantity of water which was removed from them and then cooked in the usual ways, they have much the appearance and flavor of fresh vegetables. Since the dried or evaporated vegetables, if compressed, take up comparatively little storage room and are not heavy in proportion to their bulk, they are especially desirable when space is limited or transportation difficult.

CONCLUSION.

It seems probable that with the increasing improvement in methods of production and transportation succulent vegetables will play an increasingly important part in American diets.

They do not add greatly to the total nutrients and fuel value, except in relation to the cost, but they do increase the wholesomeness of the diet in three ways, namely, by supplying it with necessary mineral matters less abundant in some other common food materials, by providing bulk desirable for the normal digestion of the more concentrated food materials, and by making the diet more varied and attractive. The last is probably the most important point in the ordinary mixed diet of persons in normal health living under the usual conditions. Moreover, green vegetables require relatively little preparation, many need only to be washed before serving, and those that are eaten cooked are usually better when simply prepared. The great number of fancy foods, pies, cakes, and so on, which American housewives so often consider necessary, are often referred to as showing their ingenuity in providing variety from a few staple materials. They can get much greater variety without anything like as much labor by utilizing such fruits and vegetables as those discussed in this article.

THE VALUE OF PREDACEOUS BEETLES IN DESTROYING INSECT PESTS.

By A. F. Burgess and C. W. Collins,
Of the Bureau of Entomology.

WORK ON PARASITIC ENEMIES OF INSECT PESTS.

During the past few years much attention has been paid to the value of the parasitic enemies of some of our common destructive insect pests, but the greater part of the work has been attempted for the purpose of introducing into this country, or transporting from one part of the country to another, natural enemies which appear to be necessary in order to bring about the control of destructive species which are new in the locality where the damage is most noticeable.

As early as 1883 a few beneficial species were introduced into this country by the Division of Entomology, now the Bureau of Entomology, United States Department of Agriculture, and since that time the work has been carried on intermittently whenever there seemed to be an opportunity to secure some valuable natural enemies of destructive insects. Similar work has been attempted and carried on continuously for a number of years by the board of horticulture of California, and, more recently, the Hawaiian Sugar Planters' Experiment Station at Honolulu has taken up this line and has succeeded in introducing several enemies of insects which affect sugar cane. The largest attempt of this sort is now being made by the State of Massachusetts in cooperation with the Bureau of Entomology of the United States Department of Agriculture in an attempt to secure the parasites and natural enemies of the gipsy and brown-tail moths in Massachusetts. These insects were introduced from Europe a number of years ago and since that time have caused widespread destruction to orchards and forests.

USEFULNESS OF PREDACEOUS BEETLES.

It is not the purpose of this article to discuss parasite work, but to point out one phase of it that is seldom given marked prominence, namely, the value of predaceous beetles. Strictly speaking, they are not parasites, but are often classed as such for convenience, as they are carnivorous and destroy their prey by feeding upon it externally, and in this way accomplish the same object but in a different manner from that of the true parasites, the larvæ of which feed internally upon the host.

Among our native beetles that are predaceous in habit are several species which belong chiefly to two families, namely, the Carabidæ, commonly known as ground-beetles, and the Coccinellidæ, or ladybirds. It is true that the tiger-beetles (Cicindelidæ) and some species of Tenebrionidæ are predaceous and that certain elaterids undoubtedly have similar habits, although very few observations have been made to show how much they accomplish in destroying insect pests. The larvæ of many of those already referred to are also predaceous, and this renders each species more effective in reducing and bringing under control injurious insects.

June 15, 1910, Mr. H. S. Barber observed near Melrose Highlands, Mass., a small burrow in the ground which contained a larva of one of the tiger-beetles, probably *Cicindela 6-guttata* Fab. Surrounding the mouth of the burrow (Pl. LXII, fig. 1) were the remains of 10 partly grown gipsy moth caterpillars which had been partially eaten by the beetle larva and cast from the burrow. Since that time we have attempted to determine whether adults of this species when kept in captivity would feed upon caterpillars. In each case a few caterpillars were eaten, but the beetles do not live long under such conditions, so that it is a difficult matter to ascertain the amount of food which they normally consume.

There are several families of predaceous beetles the adults of which live in ponds and streams. Some of these are known to feed on young fish, and in this way they may cause injury rather than benefit. The two principal families, however, about which the most is known are the Carabidæ and the Coccinellidæ. Among the latter are a large number of species which are common in most regions of the United States.

BENEFICIAL WORK OF NATIVE LADYBIRDS (COCCINELLIDÆ).

Several species, such as *Adalia bipunctata* L. (fig. 15), the two-spotted ladybird, and various species of the genus Coccinella and other closely related genera feed principally on plant-lice, insects belonging to the family Aphididæ, but sometimes attack small larvæ of various sorts.

Owing to their enormous reproductive capacity, the plant-lice are often very serious pests, as many generations are produced in a single year, and great damage would result to the crops or trees on which they feed unless their increase were checked by natural enemies or by hand suppression. The latter is seldom necessary, however, owing to the effectiveness of the former, but occasionally, when conditions are unfavorable for the increase of ladybirds, the damage is very great.

Nearly every spring plant-lice are abundant on some one or more of our common cultivated crops, or trees and shrubs. The apple aphis (*Aphis mali* Fab.; fig. 16), is sometimes very abundant and causes

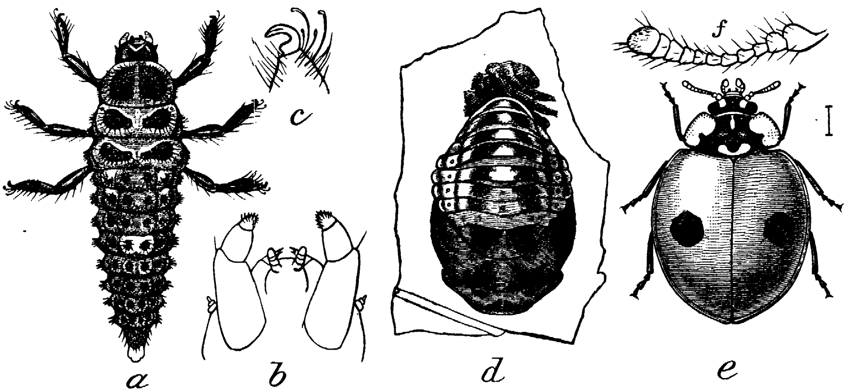


FIG. 15.—*Adalia bipunctata: a,* Larva; *b,* mouth parts of same; *c,* claw of same; *d,* pupa; *e,* adult; *f,* antenna of same. All enlarged. (From Marlatt.)

serious injury to apple trees, especially to seedlings and young stock in nurseries. It seldom becomes noticeable until the leaves on the terminal twigs or shoots begin to curl (fig. 17), owing to the presence

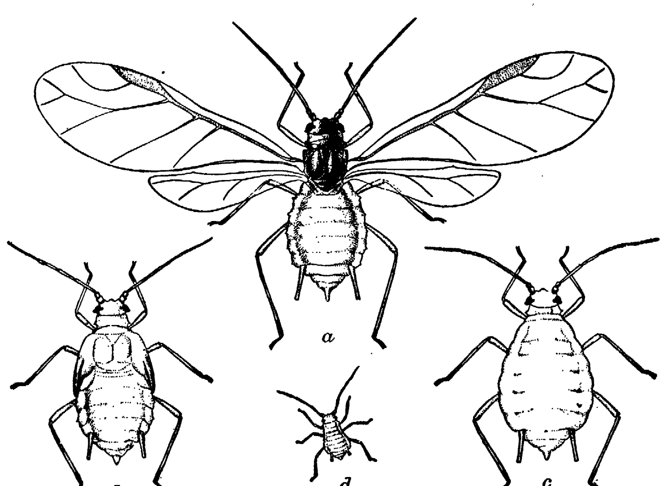


FIG. 16.—The apple aphis (*Aphis mali*): *a,* Winged agamic form; *b,* pupa; *c,* wingless agamic form; *d,* recently born aphis. All greatly enlarged. (From Quaintance.)

of large numbers of the aphides which are feeding on the sap. Before the injury proceeds very far the increase of the plant-lice is usually prevented by the inroads made upon their numbers by the more common species of ladybirds, which in both adult and larval forms feed upon these pests. It is true that some species of aphides are controlled almost completely by parasites and many are preyed upon by syrphids and lace-wing flies. The value, however, of ladybirds in accomplishing the control of many of our common species of plant-lice has never been overestimated, and it is probable that too little credit has been given these beneficial insects.

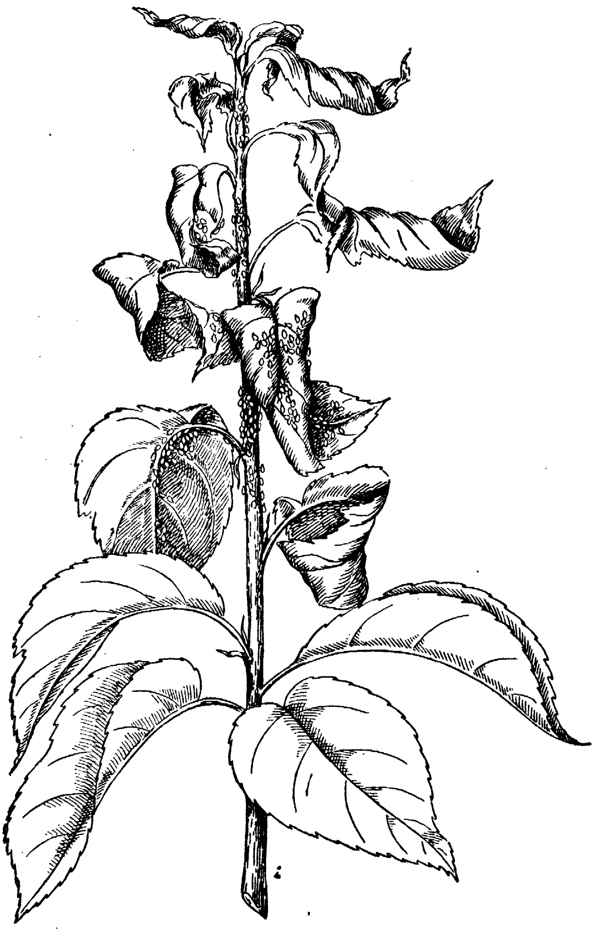
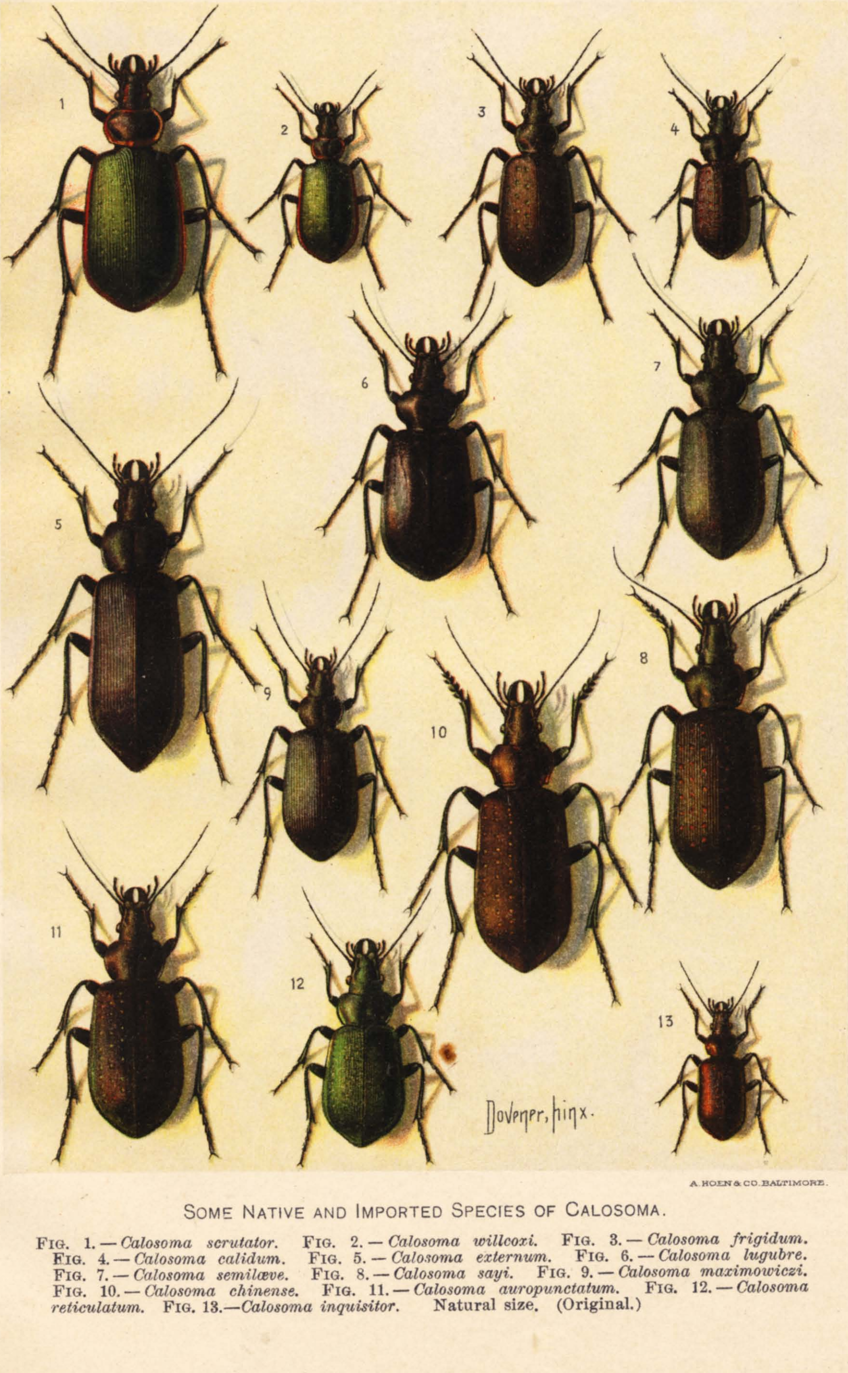


FIG. 17.—Terminal shoot of apple infested with the apple aphis (*Aphis mali*), showing condition of leaves. (From Quaintance.)

Early in the spring of 1898 Mr. A. F. Burgess observed in Malden, Mass., that the gray birches over a considerable area were thickly covered with small, black aphidid eggs. These were kept under observation for several weeks, and as soon as the weather became a little warmer, about the middle of April, several species of ladybirds, the principal ones being *Adalia bipunctata* L., *Coccinella sanguinea* L.,



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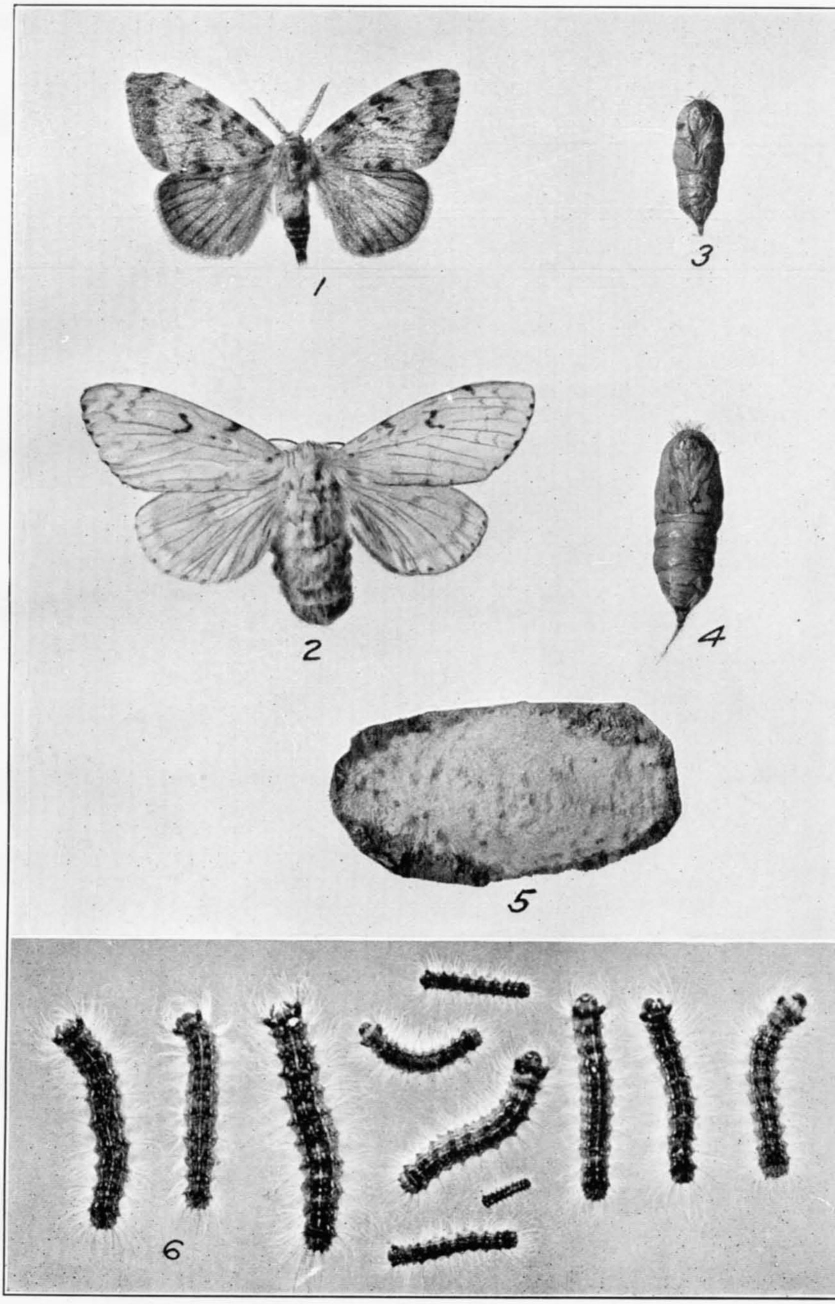
SOME NATIVE AND IMPORTED SPECIES OF CALOSOMA.

FIG. 1.—*Calosoma scrutator.* FIG. 2.—*Calosoma willcoxi.* FIG. 3.—*Calosoma frigidum.* FIG. 4.—*Calosoma calidum.* FIG. 5.—*Calosoma externum.* FIG. 6.—*Calosoma lugubre.* FIG. 7.—*Calosoma semilæve.* FIG. 8.—*Calosoma sayi.* FIG. 9.—*Calosoma maximowiczi.* FIG. 10.—*Calosoma chinense.* FIG. 11.—*Calosoma auropunctatum.* FIG. 12.—*Calosoma reticulatum.* FIG. 13.—*Calosoma inquisitor.* Natural size. (Original.)



THE GIPSY MOTH (PORTHETRIA DISPAR).

Fig. 1.—Male moth. Fig. 2.—Female moth. Fig. 3.—Male pupa. Fig. 4.—Female pupa. Fig. 5.—Egg cluster. Fig. 6.—Caterpillars; the largest are less than half grown. (From Rogers and Burgess.)

C. 9-notata Herbst (fig. 18), *C. trifasciata* L., and *Anatis 15-punctata* Oliv., made their appearance in large numbers and fed freely on the egg masses. Numerous experiments were made to determine the number of eggs that were consumed by one of these beetles, as it was apparent that the development of the aphidid was being seriously checked by the destruction of the eggs before hatching. Control experiments showed that an adult *Adalia bipunctata* averaged to destroy 100 aphidid eggs daily. Owing to the enormous number of eggs that had been deposited the previous fall it was inevitable that a large number of the aphidids would escape, but these were followed up by the ladybirds and their larvæ, so that before midsummer it was almost impossible to find a specimen in the region which had been badly infested, and in the fall the eggs of this species could be found on the trees only after prolonged search. In this case the aphidid was brought under complete control by ladybirds.

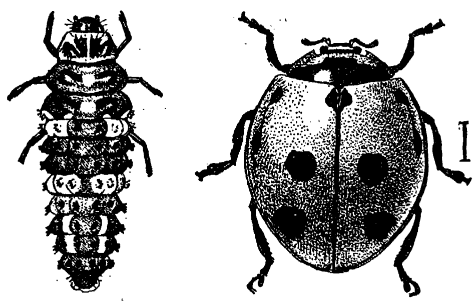


FIG. 18.—*Coccinella 9-notata: f*, Adult; *g*, larva of same. All enlarged; size indicated by hairline at right. (From Chittenden.)

During the spring feeding experiments were conducted to determine the number of aphidids which were being consumed by the various species of Coccinellidæ which were found abundantly among the infested trees. As a result of this work it was determined that on the average each beetle destroyed 60 aphidids daily, while the average number killed by each beetle larva amounted to 53 daily. The number of eggs laid by a single female of various species of ladybirds, when in captivity, ranged from 19 to 426, and seemed to depend largely upon food supply. The length of time required to develop a generation in early summer was from 30 to 52 days, depending upon the species.

It is interesting to note that several somewhat similar experiments were conducted by Dr. S. J. Hunter, in 1907 and 1908, in connection with his studies on the "green bug" (*Toxoptera graminum* Rond.) in Kansas. The results which he secured indicate that a single coccinellid beetle, when kept in captivity, will destroy from 50 to 60 "green bugs" a day, and several records are given where 100 were eaten in the same length of time. A record is given of the food consumed by one coccinellid larva, which averaged 20 "green bugs" a day.

The number of eggs deposited by coccinellids depends to a considerable extent on the food supply. Most of the species hibernate as adults during the winter, and it is probable that they are able to survive for a long time with a small amount of food. As soon, however, as the food supply is abundant a large number of eggs are laid, and the larvæ hatch and develop rapidly. In case of a scarcity of food these larvæ often destroy each other, or feed upon the eggs deposited by females of the same or other species. The number of generations, therefore, depends largely on the food supply, and this being the case it is never possible for these predaceous species to exterminate the host.

There are coccinellids which feed extensively upon those aphidids that secrete a woolly covering for the body, but *Chilocorus bivulnerus* Muls. and *Pentilia misella* Lec. (Pl. LXII, fig. 2) and closely related species feed on scale insects. These beetles are very beneficial, but the work which they do is not so conspicuous as that of the larger species previously mentioned. It is such work as this, which goes on unnoticed and usually unappreciated, that results in reducing many of our species of common insects so that they never become abundant enough to cause serious injury to trees or crops.

BENEFICIAL WORK OF NATIVE GROUND-BEETLES (CARABIDÆ).

Among the Carabidæ are a considerable number of species belonging to Calosoma, Lebia, and other closely related genera which are carnivorous in habit and feed for the most part on various species of lepidopterous and other larvæ. Most of these ground beetles are inconspicuous, and some of them feed during the night, so that their presence is seldom observed and the good work which they do is usually unnoticed.

In northern United States two of the more common species are *Calosoma calidum* Fab. (Pl. LVII, fig. 4) and *Calosoma frigidum* Kirby (Pl. LVII, fig. 3). The former is often called "the fiery hunter," and its larva is sometimes known as the cutworm and corn grub killer, owing to the fact that it feeds on cutworms and other larvæ which are ordinarily found among the roots of various plants. This species is terrestrial in habit and therefore is of little importance as an enemy of caterpillars that climb trees. On the other hand, adults of *Calosoma frigidum* climb trees and feed upon caterpillars on the trunks and branches. So far as known all the beetles of this genus lay their eggs in the ground. The larvæ which hatch from these eggs feed upon cutworms or such other insects as they may be able to secure. *Calosoma frigidum* is seldom found outside of woodland, while *Calosoma calidum* is more commonly observed in gardens or around cultivated grounds.

Two of our native species of Calosoma which are common in the eastern, central, and southern parts of the United States are brilliant green in color. The larger one, *Calosoma scrutator* Fab. (Pl.

LVII, fig. 1), is found in abundance at the electric arc lights in the spring, during the time it flies most actively. Its distribution is local rather than general, and it has been possible to collect a considerable number of specimens around the arc lights in Washington, D. C., during the month of May.

The smaller species, which is very similar in color, *Calosoma willcoxi* Lec. (Pl. LVII, fig. 2), is also secured around the lights, but is less common than its larger relative.

Calosoma lugubre Lec. (Pl. LVII, fig. 6) is found in the southern and western portions of the United States, while *C. sayi* Dej. (Pl. LVII, fig. 8) is common locally over the entire country, except in New England, and has been found as far north as British Columbia. These species resemble *Calosoma calidum* in habits, inasmuch as they are terrestrial, whereas *Calosoma scrutator* and *Calosoma willcoxi* climb the trees and feed upon such caterpillars as they are able to find.

Calosoma externum Say (Pl. LVII, fig. 5) occurs throughout the United States, except in the extreme northern part and possibly in the Pacific Coast region. The adults climb well and are able to feed in trees. One of the California species, *Calosoma semilæve* Lec. (Pl. LVII, fig. 7), is a ground form and feeds on caterpillars in cultivated land. Mr. H. M. Russell, of the Bureau of Entomology, informs us that during the spring of 1910 he captured a larva of this species which was feeding on a cutworm, *Peridroma margaritosa* Haw., in a sugar-beet field near Compton, Cal. He was able to rear the adult beetle from the larva, so that there is no doubt about the identity of the species. Several other species of Calosoma are found in the United States, but we have not had an opportunity to study live specimens.

Of the other species of Carabidæ only a moderate number of careful observations have been published. The beetles are usually scarce, except in special localities, and it is difficult to secure correct information in regard to them, as they remain in seclusion most of the time and feed to a large extent under the cover of darkness. Some of the species which are least related to Calosoma are known to feed on plants, more especially on the pollen, and it is possible that if this matter were thoroughly investigated it would be found that the beetles accomplish some good by destroying the seeds of some of our more common weeds.

In 1883 Dr. S. A. Forbes[1] published the results of stomach examinations of various species of Carabidæ and found that of 175 specimens examined, 57 per cent of the food was of animal origin, 36 per cent being composed of the remains of insects; the other 21 per

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[1] The Food Relations of Carabidæ and Coccinellidæ. Bul. 6, Ill. State Lab. Nat. Hist., 1883.

cent being made up of mollusks, earthworms, myriopods, and Arachnida. The vegetable matter eaten, amounting to 43 per cent, was composed of the remains of cryptogamic plants and the pollen of grasses and Compositæ.

Species of the genus Calosoma are not able to subsist on food of a vegetable origin. On the other hand, they are strictly carnivorous, and must eventually perish or migrate in the event of a prolonged absence of such food, although some of them are able to survive several months without animal food. Among the other carabids are a considerable number that consume a greater or less amount of vegetable food, as indicated by the dissections just mentioned, but there is little evidence to show that these insects or any of the coccinellids which are normally predatory in habit have caused serious injury to vegetation. This being the case, it is probably a distinct advantage that these insects are able to consume enough vegetable food to tide them over when insects upon which they normally feed have been reduced to insignificant numbers.

During the summers of 1909 and 1910 it was positively demonstrated that *Calosoma frigidum*, together with the minute egg parasite *Telenomus graptæ* How., brought about effective natural control of the saddled prominent (*Heterocampa guttivita* Walk.), an insect which had for two years previously completely defoliated thousands of acres of forest lands in Maine and New Hampshire. The seriousness of this outbreak can be realized when it is stated that in many areas which had been defoliated the trees were beginning to die, especially in the tops, and that the timely checking of this pest prevented the loss of thousands of acres of deciduous forests. In some sections defoliation of sugar-maple trees was so severe that the flow of sap the following spring was curtailed, which greatly reduced financial returns in the maple-sugar district. Many of the trees were so badly injured that the growth was checked, and as a result the new wood died. Such a condition is always detrimental to tree growth of any kind, inasmuch as it offers favorable breeding places for barkbeetles and other insects which feed upon trees which are weakened from any cause.

FACTS CONCERNING THE IMPORTATION OF SEVERAL SPECIES OF PREDACEOUS BEETLES.

As stated in the first part of this article, many serious attempts have been made to import the natural enemies of various insect pests and to establish them in the region of the adoption of their host. The efforts along this line have been very fully set forth in Bulletin 91, Bureau of Entomology, by Dr. L. O. Howard and Mr. W. F. Fiske, and the importation of predaceous beetles as well as true parasites is there considered.

It goes without saying that many of these attempts have been futile in bringing about the suppression of the pests, but each one of them has resulted in increasing our knowledge of the life habits of the insects concerned and has enabled us to secure information which could be utilized in other ways to the enormous advantage of the farmer and the fruit grower, which simply means that the public as a whole has profited by the discoveries made, inasmuch as in the end those who consume the products of the farm or orchard must pay their share in the increased cost of controlling by hand suppression or otherwise the pests which destroy crops.

During the years from 1890 to 1900 the State of Massachusetts expended about $1,000,000 in an attempt to exterminate the gipsy moth. (Pl. LVIII.) In the last-mentioned year the work was abandoned by the State and the moth was allowed to increase and spread without interruption for five years, when a more elaborate and expensive campaign was resumed. Although the first work on the moth did not secure the object desired—that is, extermination of the pest—the result of one of the investigations attempted was the discovery of the insecticidal value of arsenate of lead, and this material has proved so effective that to-day it is used in nearly every country in the world where spraying operations are carried on, and this was only one of the practical questions that was solved by the work undertaken by the State of Massachusetts. The same principle applies to the work of investigating natural enemies, and while as a rule the results are seldom of as widespread utility as those in the case that has just been mentioned, great and often unforeseen benefits result either directly or indirectly from such experiments.

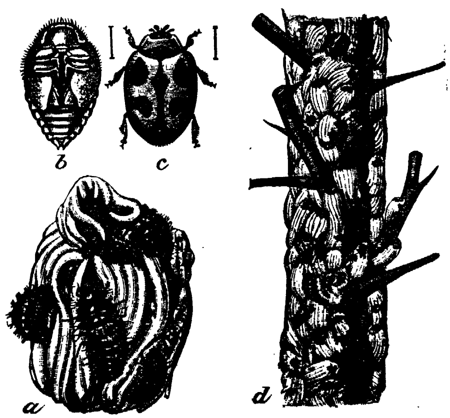


FIG. 19.—The Australian ladybird (*Novius cardinalis*), an imported enemy of the fluted scale: *a*, Ladybird larvæ feeding on adult female and egg sac; *b*, pupa; *c*, adult ladybird; *d*, orange twig, showing scales and ladybirds. *a–c*, Enlarged; *d*, natural size. (From Marlatt.)

One of the most successful attempts at introducing predaceous beetles was carried on late in the eighties by Mr. Albert Koebele, who secured specimens of *Novius cardinalis* Muls. (fig. 19) in Australia and shipped them to California for the purpose of controlling the fluted or cottony cushion scale (*Icerya purchasi* Mask.), which was then threatening the destruction of the citrus-fruit industry of that State. It is generally conceded that the result of this importation was the most striking and immediate success which has ever been accomplished from the introduction of natural enemies of insects, as the species rapidly developed and controlled the host.

During 1901 and 1902 Mr. C. L. Marlatt, of the Bureau of Entomology, conducted investigations in Japan and China for the purpose of determining the native home of the San Jose scale and of securing its parasites or predatory enemies. He concluded that the insect was indigenous to northern China, where it was apparently being controlled by an insect which has since been termed the Asiatic ladybird (*Chilocorus similis* Rossi; fig. 20), and he forwarded specimens

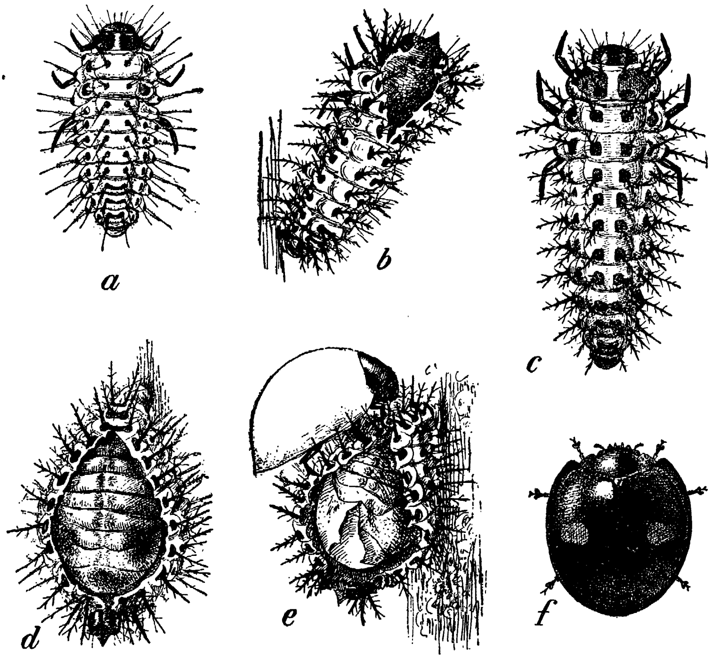


FIG. 20.—The Asiatic ladybird (*Chilocorus similis*), an imported enemy of the San Jose scale: *a*, Second larval stage. *b*, cast skin of same; *c*, full-grown larva; *d*, method of pupation, the pupa being retained in the split larval skin; *e*, newly emerged adult, not yet colored; *f*, fully colored and perfect adult. All enlarged to the same scale. (From Marlatt.)

to this country, a few of which arrived in good condition for propagation. Several colonies of beetles were liberated in various parts of the United States where the San Jose scale was abundant and where conditions appeared to favor their increase. For some unknown reason the species has apparently died out, as no specimens have been found for several years.

When the work of suppressing the gipsy moth was resumed in 1905 by the State of Massachusetts an appropriation was made for the purpose of introducing its natural enemies. Later, an arrangement was made whereby the work was taken up cooperatively with the Bureau of Entomology of the United States Department of Agriculture, and Dr. L. O. Howard, chief of the bureau, was given general supervision. Among the attempts which were made to introduce parasites was an effort to secure specimens of two predaceous beetles from Europe, namely, *Calosoma sycophanta* L. (Pl. LIX) and *Calosoma inquisitor* L. (Pl. LVII, fig. 13), as they were reported to be quite common in regions where the gipsy moth was abundant and to devour the caterpillars in large quantities.

Accordingly, in 1906 these two species were imported in small numbers, a few were colonized in the field, and since that time a much larger number of the former species has been secured, so that it has been possible, by means of rearing and colonization work, to liberate about 18,000 adults and larvæ in the area badly infested by the gipsy moth. This work has been carried on since 1906, and at the present time the beetles have been found in greater or less numbers over an area of about 400 square miles. *Calosoma inquisitor*, however, has not been successfully colonized, although it has been kept in control cages out of doors at the Gipsy Moth Parasite Laboratory and has successfully passed two winters.

As a result of the ability of *Calosoma sycophanta* to withstand winter conditions in New England and reproduce and increase in the field, considerable time has been devoted to securing accurate data on its life history, as this has an important bearing on the utility of the species.

COMPARISON OF CALOSOMA SYCOPHANTA WITH NATIVE CALOSOMAS.

In this connection several native species of Calosoma have been studied with a view to determining if possible the reason for their failure to become as effective enemies of the gipsy moth as the imported *sycophanta*. This work has been carried on for several years, and by means of assistance kindly furnished by various entomologists throughout the United States we have been able to secure live specimens of several southern and western species of Calosoma for study and investigation. As a result it has been found that the life histories of these species are quite similar and will compare very well with *sycophanta*, which has been worked out in detail.

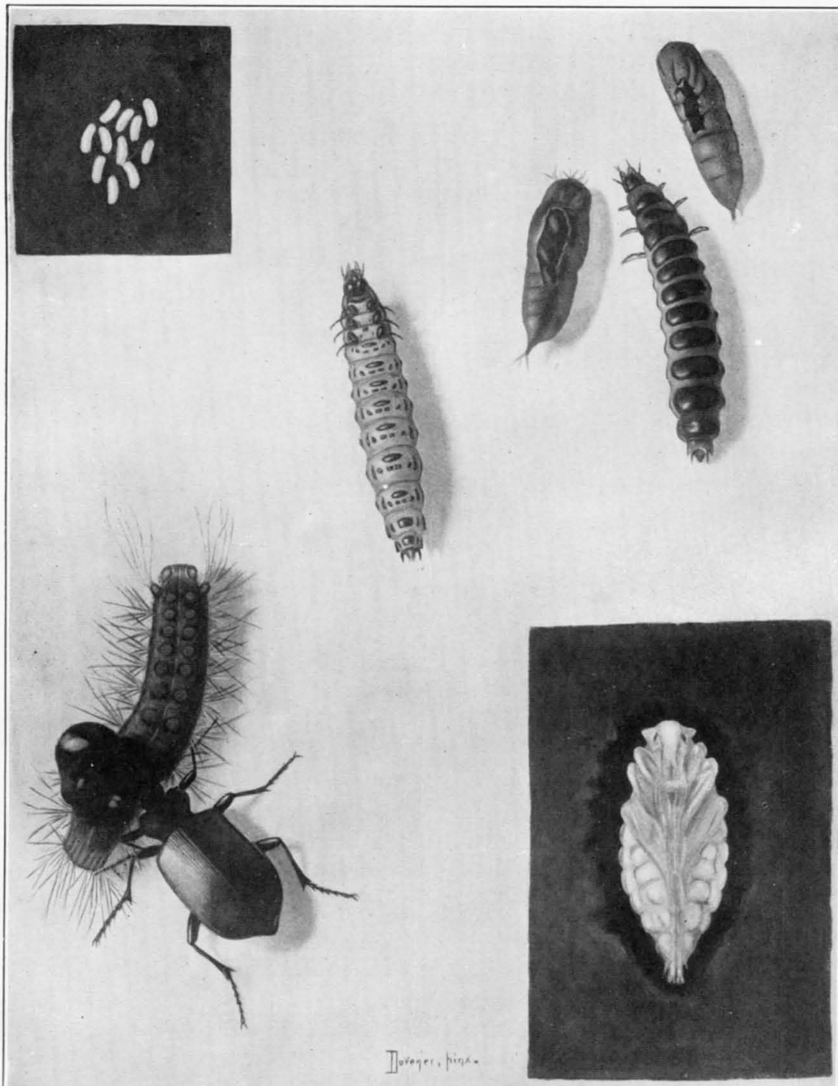
The habits of the different species vary considerably, and experiments have demonstrated that the reason why our native species are of small importance as enemies of caterpillars which feed upon the trees and pupate without coming to the ground, is because the larvæ of these beetles are not able to climb to a sufficient extent to secure food on the trunks and large branches of the trees. The larvæ of *sycophanta* are able to do this (Pl. LX), and it seems to be a fixed habit of this species for the larvæ to feed upon the caterpillars or among masses of gipsy moth pupæ on the trunks of the trees. This enables the larvæ to secure sufficient food (Pl. LXI) so that a marked increase in the number of beetles is found each year. As the larvæ of the native species must depend almost entirely upon caterpillars or pupæ which they can find on the ground or underneath débris or leaves that have fallen in the woods, rapid increase is not possible unless caterpillars having the habit of crawling or pupating on the surface of the ground become abundant.

The results of the investigation of *Calosoma sycophanta* have been published in Bulletin 101 of the Bureau of Entomology, and as most of our native species have a similar life history a brief statement is given to show the transformation of the imported species.

As adult *sycophanta* beetles have lived two or three years in captivity and under out-of-doors conditions it is probable that the life period may be longer. The eggs are deposited late in June and during July beneath the surface of the ground and, on the average, about 100 are laid annually by each female. Hatching takes place in less than a week, the young larvæ coming to the surface of the ground and crawling about rapidly in search of food. They climb trees readily if the bark is rough and molt twice before becoming full grown. This species is able to molt without descending to the ground, and it is quite common to find cast skins of the larvæ on trees where they have been feeding. Full grown *sycophanta* larvæ measure about 1¾ inches in length, and the body is very stout. In common with the adult, the larvæ feed on caterpillars and pupæ of the various Lepidoptera, but the larvæ seem to prefer female pupæ, although they are able to kill the largest caterpillars. In feeding they cut through the outer tissue of the caterpillar or pupa with their sharp jaws and feed upon the liquids and soft tissues within. The available data show that a pair of beetles of this species and their progeny will in a single year destroy enough larvæ and pupæ of the gipsy moth to prevent the deposition of 1,000 egg clusters of that insect.

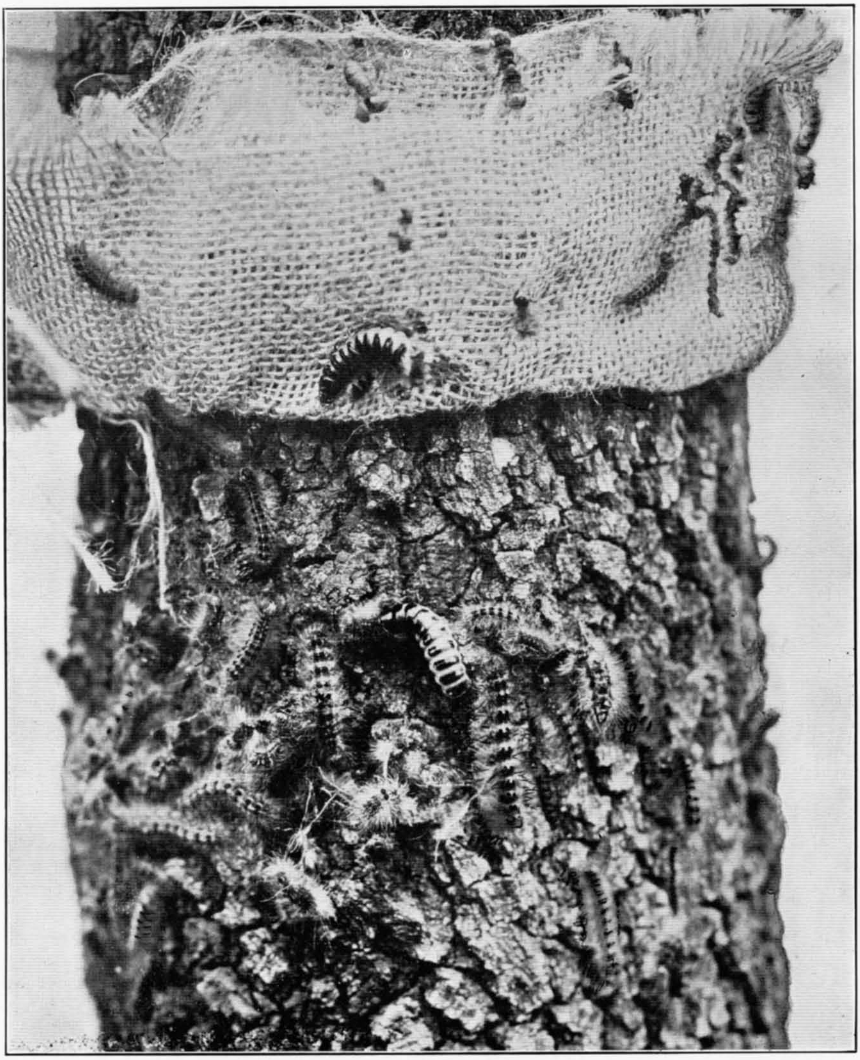
When full grown the larvæ enter the ground and make an oval chamber 4 inches or more below the surface. In this cavity pupation takes place and the beetle transforms usually by the middle of August. The insect does not seek the surface, however, but remains in the cavity throughout the winter and emerges in the spring.

In the course of the work of importing parasitic and predaceous enemies which feed upon the gipsy moth, it seemed wise to secure and introduce some of the species of Calosoma from Europe about which little was known except that they were predaceous in habit. The establishment of any beneficial species which is a general feeder is valuable, not only in relation to the problem at hand, but if it is suc-



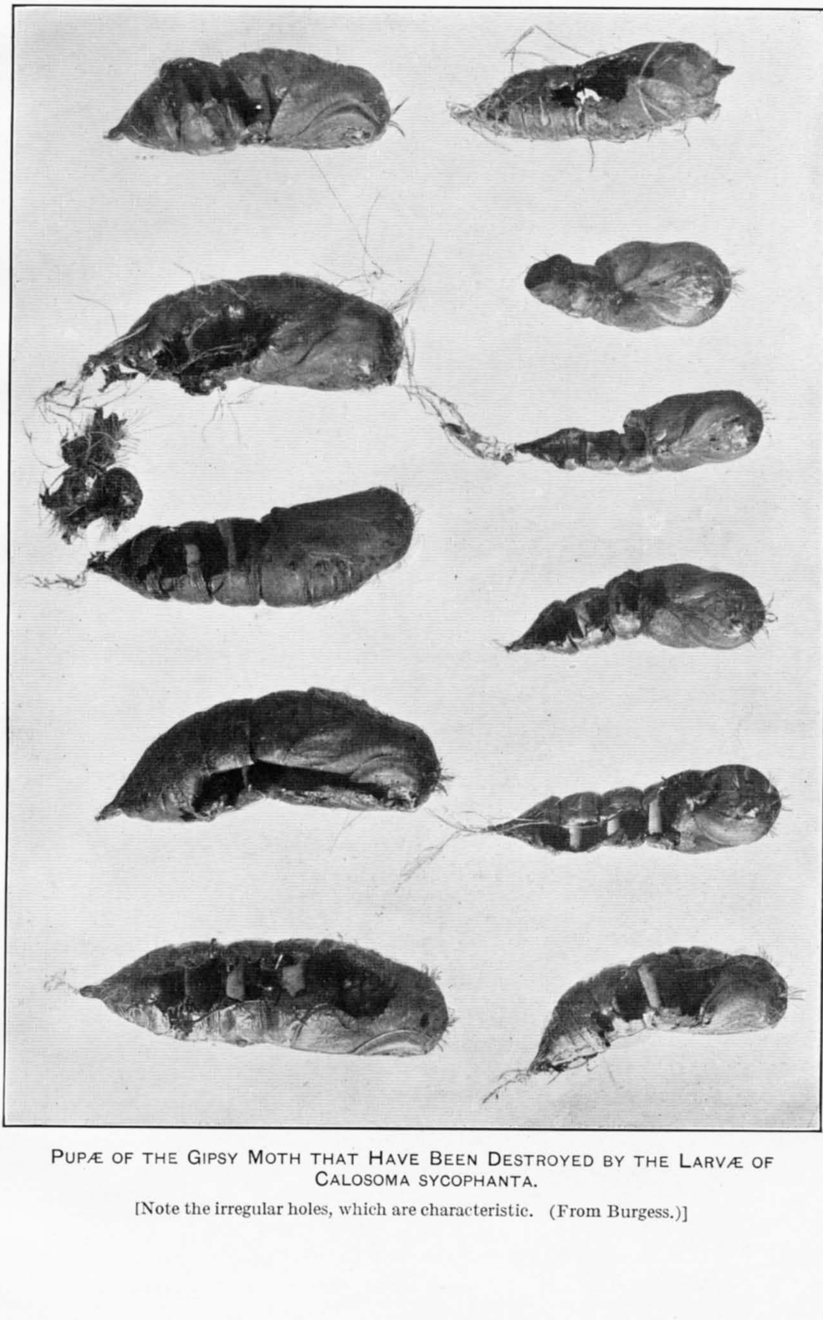
CALOSOMA SYCOPHANTA.

[Adult eating gipsy moth caterpillar, lower left; pupa, lower right; eggs, upper left; eaten pupæ of gipsy moth, upper right; full-grown larvæ from above and below. Slightly less than natural size.]



LARVÆ OF CALOSOMA SYCOPHANTA FEEDING ON GIPSY MOTH CATERPILLARS UNDER BURLAP.

[Photograph taken at Pine Banks Park, Malden, Mass., 1910. (From Burgess.)]



PUPÆ OF THE GIPSY MOTH THAT HAVE BEEN DESTROYED BY THE LARVÆ OF CALOSOMA SYCOPHANTA.

[Note the irregular holes, which are characteristic. (From Burgess.)]

FIG. 1.—BURROW OF TIGER BEETLE LARVA (CICINDELA SEX-GUTTATA) SHOWING DEAD AND PARTLY EATEN GIPSY MOTH CATERPILLARS THAT HAVE BEEN KILLED AND EXPELLED FROM THE BURROW BY THIS PREDACEOUS LARVA. NATURAL SIZE. (ORIGINAL.)

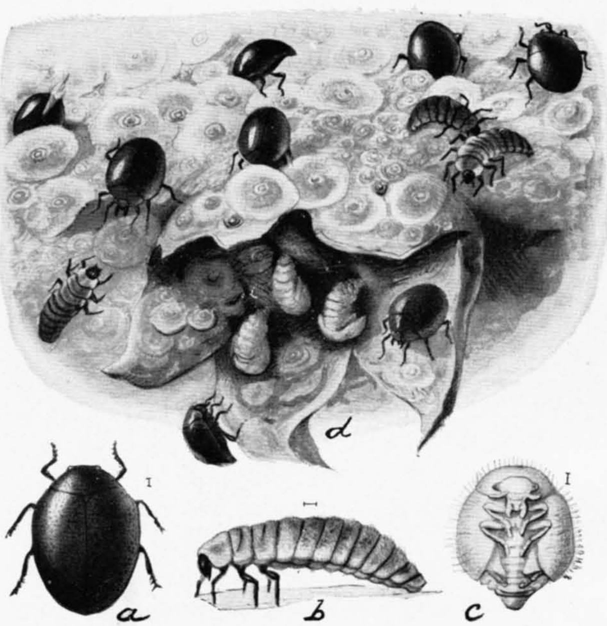


FIG. 2.—PENTILIA (MICROWEISEA) MISELLA.

[*a*, Beetle; *b*, larva; *c*, pupa; *d*, blossom end of pear, showing scales with larvæ of Microweisea feeding on them, and pupæ of Microweisea attached within the calyx. All greatly enlarged. (From Howard and Marlatt.)]

cessfully colonized and develops satisfactorily, it may do an enormous amount of good work by feeding on other destructive insects remote from the territory where it was originally introduced.

It is well known that many species of injurious insects which have been imported from foreign countries have spread with marked rapidity and caused enormous damage. There seems to be no good reason why beneficial insects should not spread as rapidly and assist in controlling injurious species if they find conditions in their adopted home suitable for their development. The trouble is that the injury caused by an insect pest is far more easily noticed and the results more readily attributed to the proper cause than would be the beneficial work done by parasites or predators, which are usually detected with difficulty.

Two other European species, namely, *Calosoma reticulatum* Fab. (Pl. LVII, fig. 12) and *Calosoma auropunctatum* Herbst (Pl. LVII, fig. 11), have been introduced, and a careful study of them indicates that they are ground forms and not likely to climb trees to any great extent. A small number of the former species has been liberated in the field, but thus far we have been unable to determine that they have survived. The latter species has not been liberated on account of the small number of specimens received. Both species have survived two winters at Melrose Highlands, Mass.

In addition to these importations which were received from Europe, several shipments have been secured from Japan, containing two species of Calosoma, one of which is known as *Calosoma chinense* Kirby (Pl. LVII, fig. 10), and is probably a ground form, while the other is known as *Calosoma maximowiczi* Mor. (Pl. LVII, fig. 9), and has been found climbing trees in the northern part of that country. The former species was received in 1911 in considerable numbers, and its ability to hibernate successfully is now being tested. The latter species, which it is especially desirable to secure on account of its possible value as a factor in controlling the gipsy moth, has not been received in large numbers, but it is hoped that live specimens may be obtained in the future. It is extremely difficult to secure live insects from a country so far distant as Japan, and great care must be exercised in handling and recording the various data and keeping accurate notes on the behavior of these insects during the time they live in captivity, which often covers two or three years.

The facts given are sufficient to establish the friendly and beneficial work which is being accomplished by predaceous beetles, both native and exotic. The benefit from the latter is likely to increase as the species spread and become abundant in sections distant from the places where they were liberated, so that in time other sections of the country will be benefited by their introduction.

Although a number of the facts which have been given are well known to some of the readers of this article, nevertheless it seems desirable to call attention to the usefulness of the insects concerned in the hope that more interest may be taken in the subject by the general public, especially among those who are interested in nature and the problems which face us in connection with food production on the farm. It is well occasionally for the virtues of the insects which are working constantly for our benefit to be considered in order that all these creatures may not be classed as our mortal foes. Many of the species mentioned and illustrated in this article are of sufficient size to be seen and recognized readily by the ordinary observer, and to him these species should appeal from sentiment and because of the useful mission in which they are engaged.

THE HANDLING AND MARKETING OF EGGS.[1]

By Harry M. Lamon,
*Junior Animal Husbandman, Animal Division,
Bureau of Animal Industry.*

DISTRIBUTION OF THE EGG INDUSTRY.

The great egg and poultry producing territories of the United States can be divided according to their geographical location and the character of the industry into three quite distinct sections. The first of these comprises the northeastern States, including New England, New York, Pennsylvania, New Jersey, and Maryland. This is a section in which the poultry industry is one of importance and where many large and specialized poultry farms are located. Inasmuch as it also happens to be the greatest consuming section of poultry products, the local production of eggs does not supply the demand, and large quantities are brought in from other parts of the country. The proximity of the poultry farms of this section to the large markets enables the poultrymen to dispose of their products readily, and it is natural that they should cater to the discriminating trade demanding a fine quality of fresh eggs. The whole tendency, therefore, is for the eggs to be shipped in small lots by express or fast freight, so as to reach the market in a short time after they are produced. These are consumed in a relatively brief time, and comparatively few eggs in this section find their way into cold storage.

The second egg-producing section comprises the States bordering the Pacific. Here the conditions are in many respects identical with those of the first section. The eggs produced all find a market in the cities of those States and the quantity is not sufficient to supply the demand. Here, also, many large poultry farms are located.

The third section comprises principally States lying in the Mississippi Valley. They are Minnesota, Wisconsin, Illinois, Michigan, Indiana, Ohio, Nebraska, Iowa, Kansas, Missouri, Kentucky, Tennessee, Oklahoma, Arkansas, and Texas. It is in this great section that the vast majority of the eggs of the country are produced.

[1] This article is largely an abstract of Bulletin 141 of the Bureau of Animal Industry, "The Improvement of the Farm Egg," by Messrs. Harry M. Lamon and C. L. Opperman. The reader is referred, therefore, to that publication, and also to Circular 140 of the Bureau of Animal Industry, "The Egg Trade of the United States," for more detailed information concerning the matters discussed.

Yet the character of the poultry keeping is quite different from that in the other two sections discussed. There are in this whole stretch of country few farms which can properly be termed "poultry farms," or where poultry raising can be considered to be one of the main branches of the farm work. The great bulk of the eggs is the product of the flocks of hens which are kept on practically every general farm throughout the whole area. These farms are devoted mainly to grain growing and live stock, principally cattle and hogs, so that the poultry kept is incidental, and the eggs produced are really in the nature of a by-product of the farm. (Pl. LXIV.)

Not much systematic care is given to the hens on these farms, and, as a result, the great majority of the eggs come in the spring and summer. Also, this section is not one of heavy consumption, and in consequence during the summer and spring many more eggs are produced than are needed locally. Only a few years ago this great surplus production resulted in such a glut and lowering of prices that in many instances it did not pay to take the eggs to town during the spring and summer, while in the fall and winter eggs were scarce and very high. With the cold storage of eggs the conditions have changed. During the spring, when production is heavy, the eggs are bought up and placed in storage, to be taken out when the period of scarcity comes in the fall and winter. As a result of storage there has been greater equalization of supply and demand throughout the year, and, what is of more importance to the farmer, the majority of whose eggs are produced in the spring, a maintenance of prices during that period much above what they were before the days of storage.

LOSS DUE TO FAULTY METHODS.

In spite of the fact, however, that prices are better than they were formerly, the producers are not receiving as much for their eggs as they should, considering the ultimate prices paid by the consumers of these eggs. This is not the result of any combination on the part of buyers to keep prices down, for competition is usually sharp enough to cause as much to be paid as the buyers can afford. The real reason lies in the fact that the system of marketing and buying eggs in this section is faulty and causes a good deal of preventable loss and deterioration. This is mainly because no incentive is offered for care and expeditious handling of the product. In other words, the careful farmer who markets good eggs as a rule gets no more for them than his careless neighbor who markets poor ones. As a result of this loss, prices paid to producers must be depressed to cover it, and this accounts for the difference between the prices paid for these eggs and the prices charged the consumers.

At first glance it might be thought that this loss and deterioration was slight and of minor importance. Quite the contrary, however, is the case. From a careful study made of the situation, it appears that the annual loss resulting from these sources in the egg trade of the country totals about 15 per cent of the value of the product, or $45,000,000. In the State of Kansas alone, where the investigations of the department have been principally carried on, the annual loss is estimated at more than $1,000,000. The table below shows some specific figures. It is a condensed report of the total receipts of three Kansas egg buyers during the months of July, August, and September, 1910, showing the number of "rots" thrown out as the result of candling, as well as the number of "seconds" and "checks" in two instances each month.

Loss in eggs received by three Kansas buyers in summer months of 1910.

Month.	Locality.	Total receipts.	Firsts.		Seconds.		Checks.		Rots.	
		Dozens.	*Dozens.*	*P. ct.*	*Dozens.*	*P. ct.*	*Dozens.*	*P. ct.*	*Dozens.*	*P. ct.*
July	A	223,230	207,240	92.9	....	......	....	......	15,990	7.1
	B	100,899	60,644	60.2	27,900	27.6	5,057	5.0	7,298	7.2
	C	36,600	28,970	79.2	5,136	14.0	....	....	2,494	6.8
August	A	160,320	133,620	83.5	....	......	....	......	26,700	16.6
	B	71,430	45,055	63.1	17,265	24.1	3,503	4.9	5,607	7.8
	C	46,500	31,151	67.0	8,997	19.3	1,978	4.2	4,374	9.4
September	B	42,710	29,659	69.5	8,460	19.8	2,083	4.8	2,508	5.8
	C	24,880	17,260	69.4	5,253	21.1	889	3.5	1,478	5.9
Total	....	706,569	553,599	78.3	73,011	10.3	13,510	1.9	66,449	9.4

The total receipts were 706,569 dozen. At 15 cents a dozen the value of the total receipts would be $105,985.35. On the basis of 6 cents a dozen less for seconds and checks than for firsts, the loss due to this class would be $5,191.26. The 66,449 dozen rots are an absolute loss of $9,967.35. The total loss, therefore, from eggs thrown out and those deteriorated in quality is $15,158.61, or 14.3 per cent of the original value.

THE COMMON METHOD OF MARKETING EGGS IN THE MIDDLE WEST.

To explain the reason for this loss and deterioration it is necessary to outline briefly the usual method of marketing eggs in this section.

The eggs, as previously stated, are produced on the general farm. The income from these is considerable and very welcome, but is, after all, incidental. The care and attention given the fowls and the product are, therefore, usually incidental also. The farmer gathers the eggs whenever convenient; sometimes each day, sometimes two or three times a week. The eggs are brought to the house and kept until there is a sufficient number to take to the village or until the farmer makes a trip to the village for some other purpose and takes the eggs along. No particular attention is given to the conditions under which the eggs are kept in the meantime. They may be put in a pantry or cupboard of the kitchen, where the temperature is comparatively high and where the eggs are bound to undergo considerable deterioration in quality or to reach a more or less advanced stage of actual spoiling. Even in those cases where the importance of a low temperature is realized and an effort made to secure this by placing the eggs in a cellar, there is likelihood that the cellar may be damp, and the eggs in consequence become moldy. Likewise, no particular effort is made to obtain clean eggs by proper attention to the nests and by frequent gathering, or to separate the clean from the soiled eggs when taking them to market. Whenever a nest of eggs is discovered in the weeds or about the barn they are usually added to the eggs in the market basket without question as to whether they are partly incubated.

As a result, the farmer may start for town with a basket of eggs, part of which are perfectly fresh and wholesome, part of them dirty or smeared, and part of them shrunken or stale or even wholly spoiled. During the drive to town it is a common occurrence for the eggs to be exposed to the direct rays of the sun for an hour or two and subjected therefore to a temperature greater than the normal temperature of incubation, 103° F. (Pl. LXIII, fig. 1.) These eggs the farmer takes to the village store and receives for them a certain price per dozen, which is usually given in trade. The village merchant is not a dealer in eggs from choice, but rather because he feels it necessary to take the eggs in order to keep the trade of the farmer. If he does not take the eggs he fears that the farmer will offer them to one of his competitors and will in consequence be likely to give that competitor the bulk of his trade. For the same reason the merchant believes that he must accept the eggs as they run, good or bad, fresh or stale, clean or dirty, for if he does not his competitors will. This system of buying by the storekeeper is known as the case-count system.

The merchant holds the eggs until he has enough to make a shipment to some egg dealer or shipper from whom he gets regular quotations. The delay here may be anywhere from two days to a week or even two weeks. Usually the conditions attendant upon the shipment of these eggs up to the time they reach the packing house are such as to cause a still further deterioration in the eggs. After they reach the packing house they are assembled in great enough numbers so that more attention and care is given their handling, and although the eggs go through one or more sets of hands from this point before they are placed in storage or reach the consumer, the deterioration which they undergo is not so great proportionately.

DELAY IN MOVING EGGS.

It will be observed that the one unfavorable factor which stands out most prominently in this system of marketing is the delay in moving the eggs. There is delay in gathering the eggs, delay in taking them to town, and delay on the part of the storekeeper. Whenever these delays are coincident with high temperatures, serious loss and deterioration result. This is evidenced by the poor quality of summer eggs.

The spoiled and deteriorated eggs compose several well-recognized classes, most common among which are the following: Heated eggs, those caused by the development of the embryo in fertile eggs; shrunken eggs, those in which a part of the water has evaporated from the white, causing a large air cell; rots, those which are totally spoiled; spots, those with localized areas of bacterial or mold infection; dirty eggs, those soiled with mud, droppings, or the contents of broken eggs; and checks, those slightly cracked.

While there is some deliberate delay in the fall, caused by the farmers holding their eggs on a rising market, the majority of the delays are due simply to indifference and consequently are preventable. The country stores are directly responsible for the delay, both on their own part and on the part of the farmer, because of the case-count system of buying which they employ. This system has nothing to recommend it aside from the fact that it is a little less trouble to the storekeeper. On the other hand, it encourages carelessness and delay on the part of the farmer, because it inflicts no penalty for poor or bad eggs. It has even bred in some farmers (who would not expect to sell damaged vegetables or grain for full value) a feeling that an injustice is being worked on them if a buyer candles the eggs and refuses to pay for those which are rotten.

As a result, therefore, of the delays and carelessness, coupled with high temperatures, there is, in connection with the handling and marketing of eggs in the Middle West, a great loss, which, because preventable in a great measure, is a wanton waste. This loss is borne both by producer and consumer, but falls mainly on the former. The consumer suffers considerably in being unable to secure good palatable eggs in sufficient quantity, and in consequence there is a curtailment of consumption. It is only fair to state, also, that these inferior eggs which find their way to the tables of city consumers are often mistaken for a cold-storage product, and the storage industry is thus unjustly discredited.

IMPROVEMENT OF THE FARM EGG.

In an effort to save a large part of this preventable loss or waste, the Bureau of Animal Industry of this department has undertaken a campaign for the improvement of the farm egg, particularly those produced in the great Middle West. A preliminary survey of the field has already been made, and the results published as Circular 140 of the Bureau of Animal Industry, entitled "The Egg Trade of the United States." This was followed during the summer of 1910 by an active campaign in the field, a report of which has been published as Bureau of Animal Industry Bulletin 141. The State of Kansas was selected as a working base, for three reasons: First, the output of eggs is large, while the quality has usually been low; second, the buyers of the State had already made at least one attempt to enforce the loss-off system of buying, which indicated a receptive spirit on their part; third, the statutes of Kansas contain provisions giving the State board of health abundant authority to prevent the sale of bad eggs within the State. The first attempt to enforce the loss-off system of buying failed because the buyers in the territory along the borders of the State met competition from adjacent States where the case-count system was in operation, became discouraged, and in self-defense reverted back to the case-count system. The other buyers of the State in turn felt compelled to return to the case-count basis, and the entire agreement soon fell to pieces.

In attacking the problem, the bureau concentrated its efforts upon those measures which were most important and which gave promise of accomplishing the most good. The two main lines were: First, the encouragement of the loss-off system of buying; and, second, a close and careful examination of the conditions surrounding the marketing of eggs all the way from production to the packing house. As has been pointed out before, the packers are keen, shrewd business men, handling a large bulk of eggs, so that they realize the necessity of good treatment after the product reaches their hands. While there is still room, no doubt, for considerable improvement in methods from this point on, this end of the trade is much further advanced at the present time, so that the greatest need for the improvement of methods of handling and thus of improving the quality of eggs is from the farm to the packing house.

ENCOURAGING THE LOSS-OFF SYSTEM OF BUYING.

Where the loss-off system of buying is in use the eggs as bought are "candled"—that is, subjected to a test which shows, quite definitely, their condition and quality. Candling is performed by holding the egg up to a small hole about the size of a half dollar, cut

FIG. 1.—TAKING EGGS TO MARKET.

[Egg case exposed to sun's rays during 8-mile drive at temperature of 106° F.]

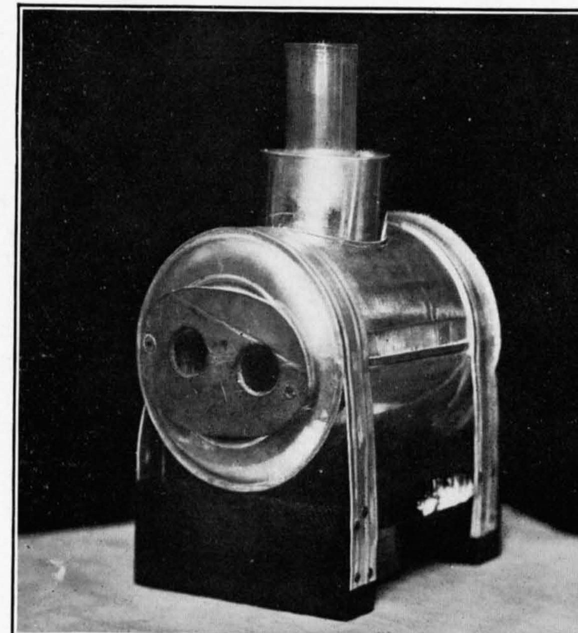


FIG. 2.—A MACHINE FOR CANDLING EGGS.

AN AVERAGE FARM FLOCK.

in a shield of metal or other material, behind which is a strong light. (Pl. LXIII, fig. 2.) Usually this light is furnished by an ordinary 16-candlepower incandescent lamp, but a lamp, candle, or even the sunlight may be utilized. The person candling the eggs is in a dark or semidark room, so that the light shines through the eggs, and when the latter are twirled they reveal to an expert eye the condition of their contents. By this test it is possible to detect rots, spots, and deteriorated eggs, such as shrunken, weak, watery, and heated eggs. In paying for eggs bought on this basis the rots and usually the spots and blood rings are thrown out entirely, so that they become a dead loss to the person responsible for them. Often in buying from the farmer no other distinction is made. The eggs are simply divided into two classes, one of which is good enough to accept and pay for, and the other is rejected and no payment made therefor. Such a classification is a distinct step forward and results in a great improvement in the eggs. Indeed, there are many reasons for believing that such a simple system is preferable when dealing with the farmers to one where other grades are made according to quality and for which different prices are paid, because the farmer is prone to think he is being cheated if a part of his eggs are accepted but bring a less price than the others.

The first step in encouraging the use of this system was to get the buyers together. With the cooperation of officers of the State board of health and the Kansas State Agricultural College, a meeting of the Kansas Carlot Shippers' Association was held in Topeka, on June 10, 1910, where an agreement was entered into to buy strictly on a loss-off basis after July 1, 1910. Profiting by the failure of the former attempt to bring about the loss-off system of buying, the persons behind this movement early enlisted the support of the State board of health. This was an important step, without which the movement would have met the same fate as its predecessor, for the activity of the State board of health served to keep the wavering buyers in line through fear of prosecution for handling bad eggs. The secretary of the board, Dr. S. J. Crumbine, was most active in supporting the movement and lent the force of his department to its successful operation. Placards in the form of a warning against the buying of eggs upon any but the loss-off system were printed and posted in 3,000 stores throughout the State where eggs were bought or sold.

INVESTIGATION OF CONDITIONS.

As a second step the efforts of the bureau were directed to a comprehensive study of the conditions in the field, and a campaign of education among the Kansas farmers was immediately begun. A packing house was selected whose manager was in sympathy with and believed in the practical good to be accomplished by such a study. The association with such a packing house made it possible to follow shipments of eggs, whenever desired, from the farm to this point and to observe changes which might occur. By virtue of enjoying the confidence and friendship of the manager it was also possible to get in touch with some of the smaller buyers and stores shipping eggs to him. Through these buyers and storekeepers it was again possible to make the acquaintance and secure the confidence of the farmers furnishing them with eggs. Thus a complete chain was established from the farm to the packing house, all parts of which had a direct interest in the egg business, and all of which were willing to give the bureau any help possible. For present purposes only those conditions will be briefly discussed which have a direct bearing on the quality of eggs.

Insufficient number of nests.—It is doubtful if any other one factor contributes more to the aggregate number of bad eggs on the farm than the lack of a sufficient number of properly located, clean nests. The average number of nests on the Kansas farms observed was 11 to every 100 hens. This means that nearly 50 per cent of the fowls are compelled to seek nests for themselves. The horse stable, straw stack, under the corncrib, or out in the weeds are the places usually chosen by the hens when a sufficient number of nests are not available. It is well known that vigorous bacterial growth depends largely upon moisture and warmth, and these factors are usually present in such places. The result is that when a nest full of such eggs is discovered, from 50 to 80 per cent of the eggs have already developed into seconds, blood-rings, and rots. If nests are provided at the rate of one for every four or five hens and kept free from vermin, it is only occasionally that a hen will lay elsewhere.

Dirty nests.—It hardly seems necessary to make any mention of dirty nests, but the investigations of the year 1911 prove conclusively that either through carelessness, neglect, or utter indifference the nests often become so filthy that the hens refuse to lay in them. When such nests are used the new-laid eggs come in contact with the droppings of the fowls (which are high in bacterial content) and may be thoroughly infected with bacteria before they are removed from the nest. This does not necessarily mean that the eggs are unfit for food at this time, but the infection having taken place, they are likely subjects for the production of spots and rots. One of the greatest needs, therefore, in improving the condition of eggs on the farm is to provide an abundance of clean nests, free from vermin.

Irregularity in gathering the eggs.—The custom of combining forces and organizing a general search party to gather in the eggs on market day is still practiced on many of the farms in Kansas. This is, indeed, a deplorable custom and there is no question that it is the cause of many rotten eggs. It is easy to see how eggs allowed to remain for several days or a week in the unsuitable places where they may have been laid, subjected probably to high temperature, wet by dew and by rain, and perhaps sat upon by a broody hen, are certain to have undergone serious deterioration, if they are not absolutely spoiled.

ALLOWING MALES TO RUN WITH FLOCK AFTER HATCHING SEASON.—Allowing the males to run with the flock after the hatching season is the usual rather than the unusual condition. Of 92 Kansas farms from which detailed information on this point is available, there were only 16 on which any effort had been made to separate the males from the hens after the hatching season, while on the remaining 76 farms the males and hens ranged together. Justification for this practice is sometimes sought in the argument that there will be some stolen nests undiscovered for so long that even the conscience cultivated by the case-count system of buying will not consent to their being marketed. If these eggs had been fertilized by allowing the males to run with the flock a part of the eggs would have hatched and the loss would not have been absolute. It should be borne in mind, however, that a much greater loss actually does occur when the eggs are fertile, for it is from the fertile eggs only that the great mass of bad and deteriorated eggs, known as heated eggs, blood-rings, and many of the rots develop. With the eradication of fertile eggs during the hot summer months the whole problem of heated eggs would be solved. Surely this is not a difficult condition to bring about if each one would do his part.

INEFFICIENT STORING FACILITIES.—This is a serious difficulty with which the farmer's wife has to contend, as a great many of the country homes in Kansas do not have dry, cool cellars, and when the thermometer begins to register from 100 to 106° F. she is at a loss to know where to keep perishable produce. To overcome this difficulty use is often made of the "cyclone cellar" or cave. In some instances these caves are of concrete construction throughout, and on such farms very little difficulty is experienced in keeping eggs in good condition. Some of the caves, however, are nothing more than oblong holes in the ground, over which a rough gable roof is built. The soil which is excavated to make the cave is thrown over this roof and thoroughly packed so as to make it cool and practically waterproof. Caves of such construction are very hard to keep clean on account of the dampness and mold, which are always present when dirt walls and floors are used, and consequently they are very undesirable as a storage room for eggs. Dampness is conducive to the rapid development of mold and bacteria, and consequently eggs kept in these caves are more likely to show deterioration than if they were held in a dry room at the same temperature.

WASHING EGGS.—The lack of the necessary number of clean nests and irregularity in gathering eggs, especially on rainy days, result in a large number of dirty eggs. These dirty eggs are offensive to the neat housewife and, in consequence, they are often washed before being taken to town. This practice, while not always harmful, may result in the egg becoming contaminated with some form of micro-organism. We have already learned that the eggshell itself is not germ-proof, for the pores that admit the air for the chick to breathe are large enough to allow the invasion of all forms of bacteria. The membrane beneath the shell, however, is comparatively germ-proof as long as it remains dry, hence the desirability of preventing dirty eggs, so that water will not have to be brought in contact with them.

HOLDING EGGS UNTIL A DEFINITE NUMBER HAVE BEEN ACCUMULATED.—The farmer often makes use of an egg case in which to keep his eggs and carry them to market. Sometimes he owns the case and sometimes it is furnished by the storekeeper. Often the case is one holding 30 dozen eggs, and as there is a tendency to wait until the case is filled, which takes considerable time with the average-sized flock, before taking it to market, the quality of some of the eggs will have suffered appreciably. Twelve-dozen size cases are also used for this purpose and are much preferable, as they encourage more frequent marketing.

Another factor which influences the frequency of marketing is the distance of the farm from the village or country store. The greater the distance, the less often are the trips made and consequently the less convenient it is to market eggs frequently. The table below indicates this tendency:

Distance of market in relation to frequency of marketing on 90 Kansas farms.[1]

Twice weekly.		Weekly.		Once in two weeks.	
Number of farms.	Average distance.	Number of farms.	Average distance.	Number of farms.	Average distance.
	Miles.		*Miles.*		*Miles.*
26	2.48	61	4.12	3	8.5

CARELESS METHODS OF TRANSPORTATION FROM FARM TO VILLAGE.—While this element of egg deterioration does not cause a marked loss or change in itself, because it occupies a relatively brief time, it is nevertheless a contributing factor. In Plate LXIII, figure 1, is

[1] On two of the farms from which detailed records are available, no eggs were sent to market during a large part of the year. On one, the eggs produced were used at home, while on the other the eggs were sold for hatching.

shown a common and faulty method of carrying eggs to market. This particular drive was one of 8 miles and the egg case was exposed to the sun's rays during the entire trip. At the time the picture was taken the thermometer registered 106° on the top of the egg case.

THE CASH BUYER.

The cash buyer or produce dealer may be in business for himself or may be the agent of some large car-lot shipper or creamery company. His method of doing business is very similar to that of the country merchant, except that he offers cash instead of merchandise. He is often not looked upon with favor by the town merchants, because they realize that the farmer prefers the cash in order that he may purchase his merchandise from the firm offering the lowest prices. As long as the merchants were able to dispose of their eggs on a case-count basis they could, by offering 1 or 2 cents more per dozen in merchandise, retain the greater part of their trade. The enforcement of the loss-off system, however, is working a slow but sure change in this practice, and a greater proportion of the trade than formerly is going over to the cash buyer.

SUGGESTIONS FOR IMPROVEMENT.

The following suggestions for the various persons interested in the egg trade are given by the authors of Bulletin 141 of the Bureau of Animal Industry. Because they indicate the important points to be observed in bringing about improvement of the farm egg of the Middle West, they are repeated here:

SUGGESTIONS FOR THE FARMER.

(1) Improve your poultry stock.

(2) Keep one of the general-purpose breeds, such as the Plymouth Rock, Wyandotte, Orpington, or Rhode Island Red.

(3) Provide one clean, dry, vermin-proof nest for every four or five hens.

(4) Conclude all hatching by June 1 and sell or confine male birds during the remainder of the summer.

(5) Gather eggs once daily during ordinary times, and twice daily during hot or rainy weather.

(6) In summer place eggs as soon as gathered in a cool, dry room.

(7) Use all small and dirty eggs at home.

(8) Market eggs frequently, twice a week if possible during the summer.

(9) In taking eggs to market protect them from the sun's rays.

(10) In selling, insist that the transaction be on a loss-off basis, for if care has been given the eggs, this system will yield more money to the producer.

SUGGESTIONS FOR THE COUNTRY MERCHANT AND CASH BUYER.

(1) Candle and buy on a loss-off basis.

(2) Allow the farmer to see you candle his eggs occasionally and return those rejected if he wishes them.

(3) Pack carefully in strong, clean cases and fillers.

(4) Do not keep eggs in a musty cellar or near oil barrels or other odoriferous merchandise.

(5) Ship daily during warm weather.

SUGGESTIONS FOR THE RAILROAD.

(1) Provide a covered portion of station platform where egg cases can be stacked and see that the agent stacks them there.

(2) Provide refrigeration for the eggs on the local freight.

(3) Where refrigerator cars are used on local freights, see that the doors are kept closed when not loading.

(4) If refrigeration can not be supplied, provide stock cars for this purpose during the summer.

(5) Where box cars are used for eggs do not allow freight which may hurt their quality, such as oil barrels, to be loaded in the same car.

SUGGESTIONS FOR THE CAR-LOT SHIPPER.

(1) Buy strictly on a loss-off basis.

(2) Encourage the smaller buyers to trade on a loss-off basis.

(3) Join the State Carlot Shippers' Association.

(4) Cooperate with other shippers and with the State officials in bringing about this system of buying.

(5) Keep the subject agitated and before the people; in other words, educate them.

SUBSOIL WATER OF CENTRAL UNITED STATES.

By W J McGee,
Soil Water Expert, Bureau of Soils.

The water supply of a country is its agricultural capital. The land forms a vehicle for carrying plants and conveying to them the immense quantity of liquid required to maintain vegetal and animal life; but it is the water that renders land productive and habitable.

The water supply of mainland United States is derived from rainfall (including snow), averaging some 30 inches annually. In ordinary farming the agricultural duty of water is to produce one thousandth part of its weight in useful plant crop; [1] and on ordinary soils the water required for full productivity is about 60 inches (or 5 acre-feet) per year. Thus the natural water supply on the nearly 2,000,000,000 acres of the country is only half that required for full productivity; and since the rainfall is unequally distributed, considerably less than 1,000,000,000 acres are sufficiently watered for even fair productivity, and nearly a billion acres more receive too little water to render farming feasible, the remaining portion being too mountainous for cultivation.

It can not be too strongly emphasized that in the present state of human control over nature inadequate water supply limits the agricultural productivity and possible population of the United States. Reckoned on the basis of 5 acre-feet of water to the inhabitant—the ratio fixed in arid regions, where alone farm water is carefully measured—mainland United States might sustain a population of 1,000,000,000, which at the current rate of increase should be attained in about three centuries, rather than the 2,000,000,000 (640 per square mile) which it could sustain if peopled to the present density of some well-watered countries; [2] with half the area and the present annual volume of water equably distributed, the capacity of the country for production and population would be as great as now, with the advantages of reduced distance and cost of transportation and of better social and industrial facilities.

Nor can it be too strongly emphasized that the arable public lands of the country sufficiently watered for farming are practically exhausted. National growth can no longer be maintained by extension of settlement over public lands; it must be kept up, if at all, by

[1] "The Agricultural Duty of Water," Yearbook, 1910, pp. 169–175; "Soil Erosion," Bureau of Soils Bulletin 71, 1910, pp. 7–14.

[2] Prospective Population of the United States, Science, vol. 34, 1911, pp. 428–435.

intensive methods—cultivating the waste lands of long-settled districts, increasing the yield of the soil, improving crop plants and modes of tillage, doubling and tripling the production of each fruitful acre—in the last analysis, by making better use of that ultimate agricultural capital distilled from the seas, borne afar by the winds, and diffused over the land in vivifying rains.

In a broad way this natural capital may be viewed as currency and reserve, i. e., (1) the seasonal rains and (2) the accumulated store of water in the ground within reach of growing plants. In restricted areas the rainfall during the growing season suffices for the production of staple crops, though even here the water is made fully effective only by temporary storage between storms in the soil and subsoil; but throughout most of the humid portion of the country the precipitation of the growing season must be supplemented by the water of rains and snows during the nongrowing season and earlier years stored in the ground, i. e., by the reserve capital of accumulated water.[1]

Throughout much of the country the reserve water permeates soil and subsoil and subjacent rocks in a quantity generally increasing downward from the surface to a variable depth, and then diminishing gradually with the increase in rock pressure, the amount within the first hundred feet of the surface having been estimated at a quarter of the total volume of ordinarily porous soil and subsoil and rock, or equivalent to a reservoir of water 25 feet in depth coextensive with the area, corresponding with some 10 years' rainfall.[2] While this water is commonly noted only as moisture in the earth, its aggregate quantity is thus considerable; and it is useful to conceive it as an actual reservoir, susceptible of increase and diminution, and differing from an open pond chiefly in unevenness of its upper level, which is due largely to obstruction of free movement by the earth matter wherein it lodges. Primarily this reservoir, like open water, moves under gravity, tending to assume a level at rates of movement varying with the permeability of the material through which it passes; but secondarily it moves under capillarity and thus, unlike free water, tends to conform in its upper level with the inequalities of the ground surface above. Under the two forces its surface or upper level is indefinite; ordinarily the moisture merely increases gradually downward until it saturates the subsoil or rock, i. e., becomes sufficient to drain away as free water into any excavation or natural opening in the ground. In this way it supplies wells and also by far the greater

[1] In some 75,000,000 acres of the United States (the swamp and overflow lands) this accumulated water is in excess and requires removal by drainage in order that these wet lands may enter on their manifest destiny of sustaining 15,000,000 to 25,000,000 families; but in far the greater part of the settled country the reserve water alone renders farming feasible and so sustains production and population.

[2] Report of the National Conservation Commission (60th Cong., 2d sess., S. Doc. 676), 1909, p. 42.

part of normal (i. e., not storm-fed) brooks and rivers, whose varying levels conform with and mark the variable level of the subterranean reservoir. For the reason that it seeps from the ground into and sustains wells, springs, and streams, it is widely known as "ground water;" but viewed in relation to that capillary movement which not only makes its surface variable and indefinite but renders it the permanent reserve of agricultural capital on which production and population depend, the subterranean reservoir may better be styled "subsoil water." The level of saturation is known as the water table, and it is convenient to distinguish the level of that saturation which is effective in supplying capillarity (which may be considered the "agricultural water table") from the generally lower level at which the water is delivered freely into wells (the "well water table").

While the quantity of subsoil water permeating the earth varies with the texture and structure of the materials, its movement varies still more widely. Through gravels and sands it flows with a freedom sometimes approaching that of open streams, while through clays and indurated rocks it may move only at an imperceptible rate—often more slowly than evaporation, so that exposed surfaces (even in open wells) are kept drier than the material beneath. This inequality of movement has little effect on the capillary delivery of the reserve moisture to the soil and to the plants rooting within it, since the rate commonly equals or exceeds the demand of the growing plants (seldom more than a small fraction of an acre-inch per day); but it, coupled with the variability and indefiniteness of upper surface, regulates the supply of water in ordinary wells, so that it is commonly said in many sections that the wells are supplied by "veins" of water, which are in most cases merely strata of sand or gravel (themselves fed by less permeable adjacent strata) delivering water freely into the wells. The limit of vertical movement of the subsoil water is of course the distance between the water table and the surface; but the horizontal movement may be considerable, especially where the subsoil is underlain by level or slightly inclined formations; indeed, recent researches indicate that the state of the subterranean reservoir at a given point may be determined by the surface-water supply at distances reaching scores or even hundreds of miles, just as artesian flow is so determined. On the whole, wells afford a fair indication of that upper level of the subsoil reservoir measured by saturation, i. e., by the presence of water in sufficient quantity to drain away from the material it permeates. Where the surface is broken and springs and brooks abound, they afford an index; but throughout much of the country the surface is too uniform to sustain brooks fed by seepage rather than storm run-off, and here wells form the most convenient means of measuring the depth of the subsoil water level below the surface of the ground.

While the effectiveness of capillary movement varies with the texture and structure of soil and subsoil and underlying rock, it may be said broadly that under average conditions capillarity acts freely to 4 or 5 feet in depth, fairly to 10 feet, and slowly to 30 or more feet. Accordingly, it is important to the farmer desirous of increasing his crop yield to know whether the reserve supply of subsoil water available for eking out the rainfall of the growing season approaches the surface to within 10 feet, or comes within 30 feet, or lies so much deeper as to be beyond the reach of capillarity; yet hitherto there has been little definite information either as to the depth of the subsoil reservoir beneath the surface or as to the source and movements of the water forming it.

With the view of obtaining specific data, a "well circular," comprising a brief general statement and a blank schedule arranged for the insertion of information relating to wells, was prepared in July, 1910; and through the courtesy of Mr. Victor H. Olmsted, Chief of the Bureau of Statistics of the Department of Agriculture, this was sent to the township crop reporters for the department, some 33,000 in number. Most of the recipients replied with reasonable promptness; and while a few either slighted the inquiry or signified inability to furnish accurate figures, the great majority filled the schedules with notable intelligence and care, and many added useful general information in the blank for "remarks" and in supplementary letters, so that the schedules form a rich treasure of definite data relating to the wells of nearly every county in the United States.

The circular was mailed late in August, and returns arrived chiefly in September, but in diminishing numbers (as the reporters obtained their figures) until 1911, when the tabulation was taken up. The data concerning individual wells were first grouped by counties; the wells were divided into two general classes, (*a*) "dug," and (*b*) "drilled;"[1] and the dates and depths, with the more noteworthy remarks of the reporters, were transferred to county sheets, the depth of the water table, etc., being at the same time reckoned. The data of the county groups were then combined in State summaries, States being divided when including two geologic provinces or types of relation between subsoil or date of settlement and water supply; e. g., Michigan was divided chiefly because the "lower peninsula" was among the early settled portions of the interior, while the "upper peninsula" was settled so much later that its well history is distinct. The

[1] While these general descriptive appellations commonly apply, the class of "dug" wells was made to include (1) driven wells, (2) most wells bored by means of earth augers, and (3) drilled wells of not more than 50 to 60 feet when either the data contained in the schedules or personal knowledge concerning conditions indicated that their relation to the water table conformed to that of the ordinary dug wells of the neighborhood; in a few cases deep bored wells were classed with "drilled" wells when either the figures of the schedules or general information indicated a like relation to the water table.

principal data for States and their divisions were then recapitulated as in the table on page 484, representing what is arbitrarily designated "Central United States"; i. e., the States of Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio, Tennessee, and Wisconsin together forming a considerable region throughout which the relations between the surface of the ground and the subterranean reservoir are much alike both as to natural conditions and as to the conditions attending settlement and cultivation.

Naturally the value of the indications afforded by the wells recorded in the 10 States depends on their representative or typical character; for since the area comprises 532,402 square miles (340,737,280 acres) of land surface and the wells number 11,034, the mean ratio is 48 square miles to a well. Happily, the distribution is fairly uniform, extending into nearly every county (with an average of 11.6 wells per county); nearly all the reporters are farmers noted in their respective townships for ability and sound judgment, and most of them reported wells made by or for themselves; so that both the distribution of wells and the character of reports, together with the inherent evidence of the schedules, inspire a high degree of confidence in the trustworthiness of the records as of typical wells.

The recapitulation of well records by States can hardly fail to be instructive and useful to farmers in what may be called the bread basket and meat hamper of the country. The mean annual rainfall ranges from some 25 inches in Minnesota to 55 in Tennessee, averaging about 38 inches, or less than two-thirds of that required for maximum productivity, so that generally the rain of the growing season would not suffice to produce full crops unless supplemented by supply from the subsoil resorvoir. Of the 11,034 wells, 10,953 indicate the depth of the water table; of these 7,498 (or 68.5 per cent) are classed as dug, and 3,455 (less than a third) as drilled. In the dug wells the mean depth of the water table (which probably runs 2 or 3 feet lower than the effective agricultural water table) ranges from 17.9 feet in Indiana to 22.6 in Wisconsin, averaging 22.2 feet, i. e., it is well within reach of capillary movement to the surface. The mean depth of the drilled wells is 124 feet, a figure of little value in connection with agriculture, since most drilled wells have a relatively great depth of standing water; the mean depth of their water tables ranges from 40.8 feet in Indiana to 81.9 feet in Wisconsin, averaging 62.3 feet. Even this figure is a much less trustworthy measure of the level of the subsoil water than that afforded by the dug wells, since the relatively small surface exposed by the bore reduces the freedom of delivery into the basin; nevertheless the combined indications of the dug and drilled wells throw light on the general condition of the subterranean store of water, especially since some of the dug wells have gone dry, while the drilled wells are

Recapitulation of well records for central United States.

State.	Number of correspondents.	Class of well.	Dates.		Wells.		Original water.		Present water.		Bi-state wells.	Changed.				Water table.	
												Rise.		Fall.			
			Number.	Mean.	Number.	Mean.	Number.	Mean.	Number.	Mean.		Number.	Sum.	Number.	Sum.	Number.	Mean.
Illinois	445	*a*	710	1880	927	29.1	738	12.7	918	10.0	734	47	92.5	401	2,053.0	927	18.9
		b	230	1896	297	122.5	204	81.6	283	76.8	191	7	35.0	44	660.0	297	46.2
Indiana	312	*a*	419	1879	576	26.5	458	11.0	563	8.5	445	25	46.5	267	1,255.5	576	17.9
		b	301	1899	363	96.3	249	59.3	328	55.4	212	1	3.0	73	691.5	363	40.8
Iowa	517	*a*	768	1875	895	36.1	749	15.4	852	11.8	711	20	83.5	373	2,503.5	895	24.1
		b	535	1895	632	153.0	506	77.8	551	74.4	449	7	62.5	128	1,831.0	607	78.7
Kentucky	314	*a*	491	1885	685	30.4	546	10.2	652	8.2	514	46	94.5	262	1,114.5	685	22.6
		b	88	1900	120	102.6	85	34.9	108	31.7	81	8	70.0	25	223.0	120	70.2
Michigan (lower)	348	*a*	508	1885	613	30.1	501	9.8	566	8.2	463	10	14.5	192	836.0	604	22.0
		b	335	1898	374	110.9	289	60.4	328	56.0	257	1	1.0	62	624.0	362	52.5
Michigan (upper)	32	*a*	59	1898	68	31.0	65	9.5	65	6.0	62	4	8.0	37	136.0	68	23.3
		b	13	1901	19	84.5	12	44.0	19	43.6	12	......	......	7	41.5	19	41.0
Minnesota	414	*a*	608	1897	678	32.0	621	11.5	630	8.4	576	22	80.5	401	2,277.5	675	23.7
		b	405	1894	480	139.3	406	69.3	396	68.5	344	7	24.0	86	999.0	457	70.7
Missouri	551	*a*	839	1884	1,127	31.6	831	11.2	1,093	10.4	779	111	374.5	178	835.5	1,127	21.2
		b	308	1900	400	134.9	288	63.1	374	61.9	269	9	62.0	40	599.0	393	69.2
Ohio	446	*a*	700	1873	907	27.4	746	10.6	880	8.3	719	8	18.0	428	1,752.0	907	19.2
		b	256	1897	336	92.1	229	54.0	296	51.6	189	2	9.0	45	464.0	336	40.0
Tennessee	269	*a*	410	1889	579	37.7	417	9.7	558	7.8	395	9	17.0	210	721.5	579	29.7
		b	108	1903	179	108.0	112	40.0	159	39.4	92	1	10.0	32	252.0	179	69.2
Wisconsin	273	*a*	395	1890	455	34.1	420	10.2	424	7.5	390	6	13.0	270	1,143.5	455	26.6
		b	277	1894	324	130.9	270	49.7	281	46.0	230	1	3.0	109	1,275.0	322	81.9
Aggregate	3,921	*a*	5,907	1884	7,510	31.4	6,092	11.4	7,201	9.2	5,788	308	842.5	3,019	14,628.5	7,498	22.2
		b	2,856	1897	3,524	124.0	2,650	63.5	3,123	60.3	2,326	44	279.5	651	7,660.0	3,455	62.3

largely in localities without other wells—and combination is the safer since the dug wells so greatly preponderate in number as to control the averages in large measure.[1] The mean depth of water tables shown by the combined wells ranges from 24.8 feet in Ohio to 40.5 in Wisconsin, averaging 35.1 feet, i. e., the indication of 10,953 wells is that the mean agricultural water table is just about the limit of capillary supply to plants growing at the surface of the ground.

The utility of these averages, of course, depends on the proportion of water tables individually lying within capillary reach of the surface, and this proportion is shown in the following table, which explains itself, save as it may be noted that the proportion of water tables within 30 feet of the surface (i. e., within agricultural capillarity) ranges from 48.6 per cent in Wisconsin to 75.7 per cent in Illinois and averages 63.3 per cent, and that the proportion within 60 feet ranges from 76.8 per cent in Wisconsin to 94.8 per cent in Ohio, averaging 85.9 per cent.

Proportionate depths of water tables recorded for central United States.

State.	Shallow wells (less than 10 feet).		Common wells (10 to 30 feet).		Deep wells (over 30 to 60 feet).		Deeper wells (over 60 to 100 feet).		Phreatic wells (over 100 feet).		Total.
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	
Illinois	179	14.6	748	61.1	203	16.6	79	6.5	15	1.2	1,224
Indiana	137	14.6	549	58.4	180	19.2	60	6.4	13	1.4	939
Iowa	150	10.0	642	42.7	373	24.8	198	13.2	139	9.3	1,502
Kentucky	82	10.2	465	57.8	186	23.1	59	7.3	13	1.6	805
Michigan (lower)	170	17.6	465	48.1	195	20.2	75	7.8	61	6.3	966
Michigan (upper)	11	12.6	49	56.3	18	20.7	9	10.4	......	......	87
Minnesota	144	12.7	487	43.0	277	24.5	136	12.0	88	7.8	1,132
Missouri	249	16.4	716	47.1	330	21.7	163	10.7	62	4.1	1,520
Ohio	190	15.3	749	60.3	239	19.2	57	4.6	8	0.6	1,243
Tennessee	30	4.0	345	45.6	258	34.0	101	13.3	24	3.1	758
Wisconsin	71	9.1	307	39.5	219	28.2	93	12.0	87	11.2	777
Aggregate	1,413	12.9	5,522	50.4	2,478	22.6	1,030	9.4	510	4.7	10,953

It is well known that when settlers pushed across the Appalachians into Ohio, Kentucky, and Tennessee the pioneer homesteads were generally located by springs; that in the course of a decade or two many of the springs failed, and shallow wells were dug for domestic supply; and that these wells in turn frequently failed and were

[1] In a few cases wells in a particular county or district depart so far from the mean for the State as perceptibly to affect averages, the most striking example being extreme northeastern Iowa, where the geologic structure is such that nearly all wells are drilled to depths ranging from 100 to 500 feet; if the 56 wells recorded from Allamakee, Clayton, and Winneshiek Counties were deducted from the aggregate, the mean depth of wells for the State would be reduced from 84.4 to 80.3 feet, and the mean depth of water table from 46.1 to 42.5 feet.

either deepened or replaced by drilled wells—facts interestingly described by several reporters, some of whom record continuous residence on the same homestead for 50 to 86 years. It was partly to obtain specific information concerning change in level that provision was made in the schedule for dates and for both original and present water levels; yet the circular was cautiously framed in order not to present a leading question, the language on this point being:

In some cases settlement and cultivation have been followed by changes in the water level. These changes are best shown by variation in the depth of standing water in wells.

Of the 11,034 wells, 8,114 give the depth at two dates, and are classed as "bi-state wells;" of these 4,092 (just above half) show no change, while 3,670 indicate lowering and 352 indicate rise of the water level. Now, other things equal, the water level in both dug and drilled wells would normally rise somewhat with time (except as drawn down by excessive use), since the interstices delivering water into the basin tend to enlarge with continued flow; so that the general lowering in well-water level can only be viewed as marking a lowering of the subsoil reservoir—the reserve store of agricultural capital. The proportion of water tables changed varies from State to State. The number of wells showing change in water table ranges

Résumé of well data for central United States.

State.	Dates.		Total wells.		Bi-state wells.				Water tables.		Mean lowering per decade.
	Number.	Mean.	Number.	Mean depth.	Total.	Unchanged.	Changed.	Mean lowering.	Total number.	Mean depth.	
Illinois	940	1884	1,224	51.7	925	426	499	2.80	1,224	25.6	1.077
Indiana	720	1887	939	53.5	657	291	366	2.89	939	26.7	1.256
Iowa	1,303	1887	1,527	84.4	1,160	632	528	3.61	1,502	46.1	1.570
Kentucky	579	1887	805	41.2	595	254	341	1.97	805	29.4	.856
Michigan (lower)	843	1890	987	60.7	720	455	265	2.01	966	33.4	1.005
Michigan (upper)	72	1898	87	42.7	74	26	48	2.29	87	27.2	1.908
Minnesota	1,013	1896	1,158	76.5	920	404	516	3.45	1,132	42.8	2.464
Ohio	956	1880	1,243	44.9	908	425	483	2.41	1,243	24.8	.800
Tennessee	518	1891	758	54.3	487	235	252	1.94	758	39.0	1.023
Wisconsin	672	1891	779	74.5	620	234	386	3.87	777	49.5	2.037
Aggregate	7,616		9,507		7,066	3,382	3,684		9,433		
Average		1888.3		61.3				2.85		35.1	1,315
Missouri	1,147	1888	1,527	58.7	1,048	710	338	.95	1,520	33.6	.432
Grand aggregate	8,763		11,034		8,114	4,092	4,022		10,953		

from 64.9 per cent in lower Michigan and 62.3 per cent in Wisconsin to 31.3 per cent in Missouri, averaging 52.1 per cent. The average lowering of water table during the period of observation ranges

gradually down from 3.87 feet in Wisconsin and 3.45 in Minnesota to 1.94 feet in Tennessee, and then drops to only 0.95 foot in Missouri. Since the interval (measured both in percentage of wells changed and in amount of lowering) by which Missouri is separated from the next State in the series exceeds any other—i. e., since " the differences are greater than the resemblances "—that State naturally falls into a class by itself; and a résumé of the records relating to change in level of water tables, in which Missouri is set apart, is shown in the table on page 486. The mean rate of lowering per decade for the nine States excluding Missouri (1.315 feet) is equivalent to a total lowering of 10.5 feet in the 80 years which have elapsed since permanent settlement and cultivation began to extend into Illinois and Wisconsin and on into Iowa and Missouri. Part of the lowering recorded is undoubtedly traceable to special causes; some reporters, especially in Indiana, Illinois, and Minnesota, ascribe local lowering to land drainage; a few in Ohio and Michigan trace failure and deepening of wells to mining; a good many in Ohio, Indiana, Michigan, and other States ascribe the change to deforestation, and several note that the drilling of deep wells for large use is followed by failure of common wells for ordinary use; yet it seems clear that the records broadly indicate a secular lowering of the subsoil-water level, presumably due to clearing and cultivation of the land. Assuming that the water forms 25 per cent of the volume of the saturated subsoil, the actual loss of water averages 3.948 inches per decade.

The mean rate of lowering is computed from the aggregate number of bi-state wells, although many of these are so conditioned (located in stream bottoms, fed by permanent underflow, etc.) as hardly to be susceptible of change within the period of observation, while most of the unchanged wells are comparatively new. If half the unchanged bi-state wells (excluding Missouri) be eliminated for these reasons—and this is a moderate allowance in the light of the individual records—the rate of lowering increases to 3.75 feet for the mean period, equivalent to 1.73 feet per decade or 13.8 feet for the 80 years since settlement. These figures are undoubtedly nearer the truth than those derived directly from the records.

The " mean lowering per decade " shown in the table on page 486 varies widely from State to State, ranging from 2.464 feet in Minnesota down to 0.8 foot in Ohio and only 0.432 foot in Missouri; yet examination proves that the variation is by no means random—indeed, it appears to be largely if not wholly systematic. Two conditions affecting the variation are especially noteworthy, namely, (1) the relation of the records to time of settlement, and (2) the relation of the surface in each State to the general subsoil-water reservoir of the country as a whole.

Both the individual records and the computed means indicate relatively more rapid lowering of the water table within a few years following settlement than long after. Thus, the late-settled States of Minnesota and Wisconsin[1] give higher rates than any of the longer-settled States; while recently settled upper Michigan shows a rate of lowering almost double that of long-settled lower Michigan. The facts, while occasioning surprise as the computation proceeded, are in accord with common knowledge concerning the comparatively rapid transition from springs and shallow wells to common wells on pioneer homesteads. In some measure they are a hopeful sign, suggesting that the secular lowering of the subsoil water is proceeding at a gradually reducing rate. Nevertheless this condition is a minor one and subordinate to the more general relations of the subsoil water to the surface.

The relation of surface to subsoil reservoir is most clearly shown for Missouri by the facts warranting its separation in a distinct subsoil-water class. Of the 10 States summarized, Missouri alone is, in surface configuration and in geologic structure, a direct extension of the Plains, Iowa and Minnesota being cut off surficially by the valley of the Missouri River and structurally by a generally distinct series of geologic formations. Recent researches in the Plains region have shown that this extensive area of generally meager rainfall is watered partly by natural subirrigation, i. e., by an extensive underflow from the Rocky Mountains which not only supplies artesian wells in the Dakotas, Nebraska, Kansas, Oklahoma, and Texas, but also escapes upward through confining strata and subsoil at such rate as to supply an (estimated) average of 4 or 5 inches of water yearly supplementing the rainfall and materially increasing the productivity of the Plains. Hitherto it has been assumed that this underflow did not extend beyond eastern Kansas, and did not enter the Paleozoic strata of the interior; but the well records forcibly suggest—indeed, virtually demonstrate—that Missouri derives a considerable share of subsoil water from the residuum of that eastward flow through the Plains from the mountains beyond which helps to fructify Kansas, Nebraska, and Oklahoma. Next to Missouri in rate of lowering stands Ohio, most of whose northern boundary is Lake Erie; and the recent inferences concerning the lateral movement of subsoil water suggest that the common, like the artesian, wells of this State are kept up in part by seepage through the subsoil and underlying strata from the lake toward the deeply cut

[1] In Minnesota and northern Wisconsin the spring and summer of 1910 were exceptionally dry, and some reporters ascribe the lowering of water in wells to this fact, while others give reasons for deeming it of little effect. On the whole, it seems probable that the drought increased by a few inches the general lowering for these States, the amount being presumably counterbalanced in the mean for the region by the heightened stage of water ascribed to exceptional rains in Tennessee, Kentucky, and some other States.

valley of the Ohio River—a loss to Lake Erie serving to explain that limited outflow through Niagara which has puzzled engineers and geographers and led to assumptions of excessive evaporation from this lake. Next stand Kentucky and Tennessee, in which the recorded wells preponderate in the lowlands presumably supplied by subsoil flow (as are the rivers by surface flow) from the Appalachian Mountains and foothills, together with lower Michigan, a low-lying plain bordered on both sides by lakes, and of such structure as to facilitate seepage—indeed, several reporters note that the stage of wells is affected by lake winds. Then follow Illinois, generally sloping in surface and strata away from near the shore of Lake Michigan, and Indiana, touching Lake Michigan and approaching Lake Erie. Next is Iowa, so situated as to receive both subsoil seepage and surface drainage from southern Minnesota; then upper Michigan, bordered by lakes but generally so elevated that the seepage must be lakeward rather than landward, and Wisconsin, of which the same is true, coupled with free drainage into the Mississippi; while the highest rate of change is in Minnesota, the most elevated part of the region, whose sole source of water supply is local rains without appreciable surface inflow or seepage from surrounding land or water. In short, the relative rates of lowering indicate clearly that the subsoil reservoir of the entire region is essentially a unit; that the slow movement of the subsoil water must extend from lake to land and land to lake and on from State to State according to local drafts on the reserve in the forms of well water, both artesian and common, and surface run-off; and that the directions of subterranean flow correspond broadly with the directions of surface slope and drainage.[1]

The draft on the reserve through wells (and indirectly through taking water from rivers and lakes interdependent with the subsoil reservoir) is, of course, one cause for the lowering of the level of subsoil water, but any quantitative estimate indicates that it is by no means the chief cause. The ordinary domestic consumption of water may be estimated at a ton (about 240 gallons) per year per capita for a human population for drink, or ten times that (equaling 320 cubic feet) for the various personal uses and wastes; and it may roughly be estimated that twelve times this amount is required for use and waste by live stock, giving an aggregate consumption and waste of water by men and animals amounting to 4,165 cubic feet per capita per year for a largely rural population such as that of central United States. This estimate is somewhat less than the average consumption (and waste) in cities and towns; the mean for American cities (in which manufacturing operations consume much water) is about 150

[1] It may be noted that the far-reaching movement of subsoil water is brought out even more fully in the records for other States, in most of which the slopes are higher. The entire body of data is well advanced in preparation for issue as bulletins of the Bureau of Soils.

gallons, and the average for cities and smaller towns is about 100 gallons[1] per capita daily, equivalent to 4,876 cubic feet yearly. At this higher rate the 30,319,129 inhabitants of the ten States in 1910 would consume 3,394,058 acre-feet, or almost exactly 0.01 foot over the aggregate area of 340,737,280 acres, each year; a quantity equivalent to 1.2 acre-inches per decade, or only 30 per cent of the actual loss of water (3.948 inches) indicated by the lowering wells. Thus the chief cause of lowering must be sought elsewhere than in actual consumption by men and animals, and passing over the consumption by plants (which on the average has probably diminished rather than increased in consequence of clearing and cultivation), it would appear that this dominant cause is the loss of storm and snow water through surface run-off unretarded by adequate cover, especially during the nongrowing seasons—the same excessive run-off that leaches and impoverishes the soils of rolling country and initiates destructive soil erosion in hilly lands.

On the whole, the well data render definite and specific certain widespread impressions and inferences, hitherto necessarily vague, and help to establish the quantitative method of dealing with the water supply of the country as a unit. The results are in accord with common knowledge—of the failing of springs and wells following settlement, of the dwindling and disappearance of brooks, of the advancing destruction by floods due to increased surface run-off during and after storms, of the increasing difficulty in obtaining domestic water supply for farms, villages, towns, and cities, of the steadily growing danger of crop loss through drought, of the increasing need for irrigation in the humid section. The figures make clear both the fact that the reserve agricultural capital of the country is shrinking and the rate of its diminution. The lesson of records and results is simple. Each acre at the best, and each farm at the least, must be made to take care of all of the water with which it is blessed, leaving none to run off on the surface and not too much to escape by drainage and seepage; in this way alone can the ultimate agricultural reserve be maintained.

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[1] In 62 cities and towns in Missouri the average daily use of water is 80 gallons per capita. (First Biennial Report of the Missouri Waterway Commission, 1911, p. 7.)

A NEW RESPIRATION CALORIMETER FOR USE IN THE STUDY OF PROBLEMS OF VEGETABLE PHYSIOLOGY.

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INTRODUCTION.

A respiration calorimeter of special construction and of suitable size for experiments with fruits and plant products in general, as well as for other uses, has been constructed as part of the equipment of the calorimeter laboratory of the Office of Experiment Stations. The success which attended several series of experiments made in cooperation with the Bureau of Chemistry with fruit during the ripening period made it clear that respiration calorimeter methods are applicable to the study of such problems and that a specially constructed respiration calorimeter would be of great advantage in this kind of work.

There are many problems of agricultural interest which must be studied in great detail in order that agricultural practice may rest on a sure foundation. Such experimenting is less costly in the end if it is carried on in the laboratory rather than in the field or orchard, in the storage warehouse, or in the consumer's home. The great development of storage and transportation which brings the fruits and vegetables of summer to the consumer at all seasons of the year involves special systems of growing the crops and methods of handling, storing, and marketing them which are very different from those followed if the fruits and vegetables are to be used within a few miles of the garden or orchard in which they are grown and within a few hours or a few days after they are gathered. Varieties which have certain qualities of texture as well as of appearance and flavor are essential, as well as a system of handling which insures good condition when used.

One is apt to think of fruits and vegetables when picked or gathered as no longer living things. This is far from the truth. As is well known, the capacity for growth is present in the ripened seed for months or years, which, of course, means that, though dormant, the seed is still living. Given favorable conditions the vital processes which seem to have ceased again become active. It is equally true that the fruit or vegetable is living after it is gathered and may continue to live for a relatively long time. The green tomato which reddens and ripens when placed in a kitchen window where the sun shines upon it and the apple which mellows when stored in the cellar do this, not because they are chemically changed by the warmth or other conditions of their environment, but because they are living things, in which processes like those of normal ripening are being brought about by the usual agencies but under different conditions from those which prevail when the fruit remains on the stem. Many, perhaps most, of the changes of ripening to perfection and of after ripening, which usually means loss of quality, are due to the action of ferments normally present in the plant or plant product. These ferments, or, as they are also called, enzyms, are the immediate causes of many of the changes which are known as life phenomena and which can be followed in their course. The agencies and the manifestations are known, but how these contribute to the mystery—life—is not understood.

Warmth and sunlight, which develop color, flavor, and texture of ripening fruits, do this, very largely at least, because they favor the action of enzyms in the plant tissues which bring about these changes. Low temperature and absence of sunlight, which are conditions which are sought in storing and transporting vegetables and fruits, are of value because they retard the course of ripening processes; that is, hinder the action of the plant ferments.

Living plants and plant products take material from the air and give up material to it as a necessary part of their life processes, or, in other words, they "breathe," to use the term broadly. Furthermore, they produce heat as a result of the work which goes on in their cells. In all this they show a close analogy to the animal body, which breathes in oxygen and gives off carbon dioxid and water vapor and liberates heat as a result of the work involved in respiration and other vital processes and in muscular work in general. The subject of plant respiration is very complicated and only those factors are referred to here which are directly analogous to respiration processes in animals, including man.

Many problems which have to do with the use which man makes of his food, his efficiency as a machine for the performance of muscular work, and other equally important topics can be advantageously studied by measuring accurately these respiratory changes and heat factors with an instrument of precision, the respiration calorimeter. Since the processes in plants are analogous, it seemed probable that they could be studied by like methods and would yield results of comparable value. That this was the case was demonstrated by experimental work with ripening bananas, carried on by the Office of Experiment Stations cooperating with the Bureau of Chemistry.

Three to six bunches of green bananas were placed in the respiration chamber of the large calorimeter used for experiments with man and allowed to remain there at a temperature of about 68° F.; that is, at the usual temperature of a living room. In 5 to 9 days the fruit turned yellow and ripened as it does under similar conditions in the commercial ripening of bananas in banana cellars, developing the aroma and flavor of well-ripened fruit. During this ripening process the enzymic action or other causes of ripening brought about the taking up of oxygen by the fruit and the production of carbon dioxid and water and the liberation of heat. In each case the quantities were measured throughout the experimental period in the same way that they are measured in experiments with man as subject inside the respiration chamber.[1] As has been pointed out in a brief statement[2] regarding this work, it was found that carbon dioxid, water, and heat were produced in quantities sufficient for measurement, the rate of production and other details showing that these factors have a direct relation to the progress of the ripening processes and that they supplement the conclusions which can be drawn from chemical analyses of the fruit before and after the ripening period, such as were made in connection with these cooperative experiments.

If the changes which take place in ripening fruit are followed, as they can be in such experiments, and are thoroughly understood in their chemical and physical relations, it is reasonable to suppose that the results can be applied outside of the laboratory with benefit to those who produce, ship, handle, or consume fruits.

Processes in ripening fruits can be studied with the respiration calorimeter which it has not been possible to study hitherto with anything like the same degree of accuracy or completeness, and it is for this reason that the respiration calorimeter is being used in cooperation with the Bureau of Chemistry to supplement the results already obtained, by other methods, which have to do with the ripening and storage of fruits.

The data collected showed so conclusively that the experimental method is suited to the study of problems of plant life that the construction of a respiration calorimeter of suitable size for experiments with a single bunch of bananas or a comparable amount of other fruit or vegetable products was undertaken. In the course of this work improvements and conveniences were introduced which make for ease of operation under the experimental conditions, and make the calorimeter particularly suited to the purpose for which it is designed.

The new respiration calorimeter stands in the same laboratory room as the large apparatus for experiments with man, and the two can be operated at the same time when this seems desirable.

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[1] U. S. Dept. Agr. Yearbook, 1910, p. 307.
[2] U. S. Dept. Agr., Office Expt. Stas. Circ. 116.

The new apparatus greatly extends the possibilities of respiration calorimeter work by the department, as an aid to the solution of agricultural problems. Plans have already been formulated for cooperative work with different bureaus in the study of subjects in which the department is interested.

GENERAL DESCRIPTION OF THE NEW RESPIRATION CALORIMETER.

The new respiration calorimeter does not differ materially in general plan and in equipment from the larger instrument, save that additional parts of the temperature-controlling apparatus have been made automatic in operation, thus lessening the labor of making experiments and adding to the accuracy of the results. Improvements have been made in the grouping and adjustment of several devices making up the apparatus as a whole, which make it easier to operate and lessen the difficulties in making repairs, alterations, or changes should such be needed.

The respiration calorimeter as a whole consists of an inner respiration chamber with a protective covering and such accessory apparatus as is needed for its operation and control for experimental purposes. The respiration chamber in which the fruit is placed for study is an air-tight and heat-tight rectangular box about twice as tall as it is wide and having a cubical capacity equal to about one twenty-sixth that of the respiration chamber of the large apparatus designed for experiments with man. Surrounding the metal chamber and separated from it by an air space is a thick outer covering which is a poor conductor of heat and so protects the respiration calorimeter chamber from temperature changes in the room in which the apparatus stands.

To make the chamber air tight, the few seams in its copper walls have been very carefully soldered together, and during an experiment all the openings into it are sealed. Air is forced through the chamber continuously throughout an experiment, the air current being maintained by a positive rotary blower. As it leaves the respiration chamber in the outgoing air pipe, the air passes through vessels containing chemical substances which remove from it the products of respiration, namely, carbon dioxid and water. It then passes through a return air pipe into the respiration chamber, and at the same time oxygen is added to the air in the chamber to make up for that which had been withdrawn to supply the oxygen needed in the respiration processes of the fruit or other material under investigation. Since the oxygen is drawn from a weighed cylinder, and since the water and carbon dioxid are collected in separate weighed vessels, the amounts of these three substances involved in a given experimental period are easily determined. This purification and circulation of air and addition of oxygen is continuous throughout an experiment.

To make the respiration chamber heat tight, provision has been made for preventing gain or loss of heat by radiation and convection through its metal walls, or by carrying heat in and out of the chamber in the ventilating air current. Heat gain or loss through the metal walls of the respiration chamber is prevented by keeping the two walls all the time at the same temperature. Under such a condition of heat equilibrium in the walls heat can not pass from the outside into the chamber or from the inside out. Similarly, if the temperature of the ingoing air current be kept identical with that of the outgoing air the calorimeter neither gains nor loses heat in the circulating air. In the large respiration calorimeter differential thermocouples are used to detect temperature differences in the ingoing and outgoing air current and between the two walls of the respiration chamber, requiring the attention of the operator to read the galvanometer with which the couples are connected and to adjust by hand the devices for obtaining heat control of the walls. In the new respiration calorimeter delicate differential electric resistance thermometers detect temperature differences between the walls of the calorimeter and between the ingoing and outgoing air currents, and these are connected directly with and form part of an apparatus which automatically adjusts the devices for controlling the temperature of the outer wall to agree with that of the inner wall, and that of the ingoing air to agree with that of the outgoing air, until heat equilibrium is secured and maintained and heat is being neither added to nor subtracted from the respiration chamber through the walls and in the air current.

In order that it may be measured, heat generated in the respiration calorimeter is carried out under controlled conditions. This is accomplished by taking up the heat in a current of cool water which flows through a metal pipe coiled around the upper part of the inner walls of the chamber; in other words, by a method which is the reverse of that followed in heating a room by means of hot water passing through pipes or a radiator. The amount of heat is determined by measuring the temperature of the water as it enters and leaves the heat-absorbing system and by measuring the quantity of water which passes through the system in a given time. From these values the total heat brought from the respiration chamber by the water flowing through the heat-absorbing system may be readily computed.

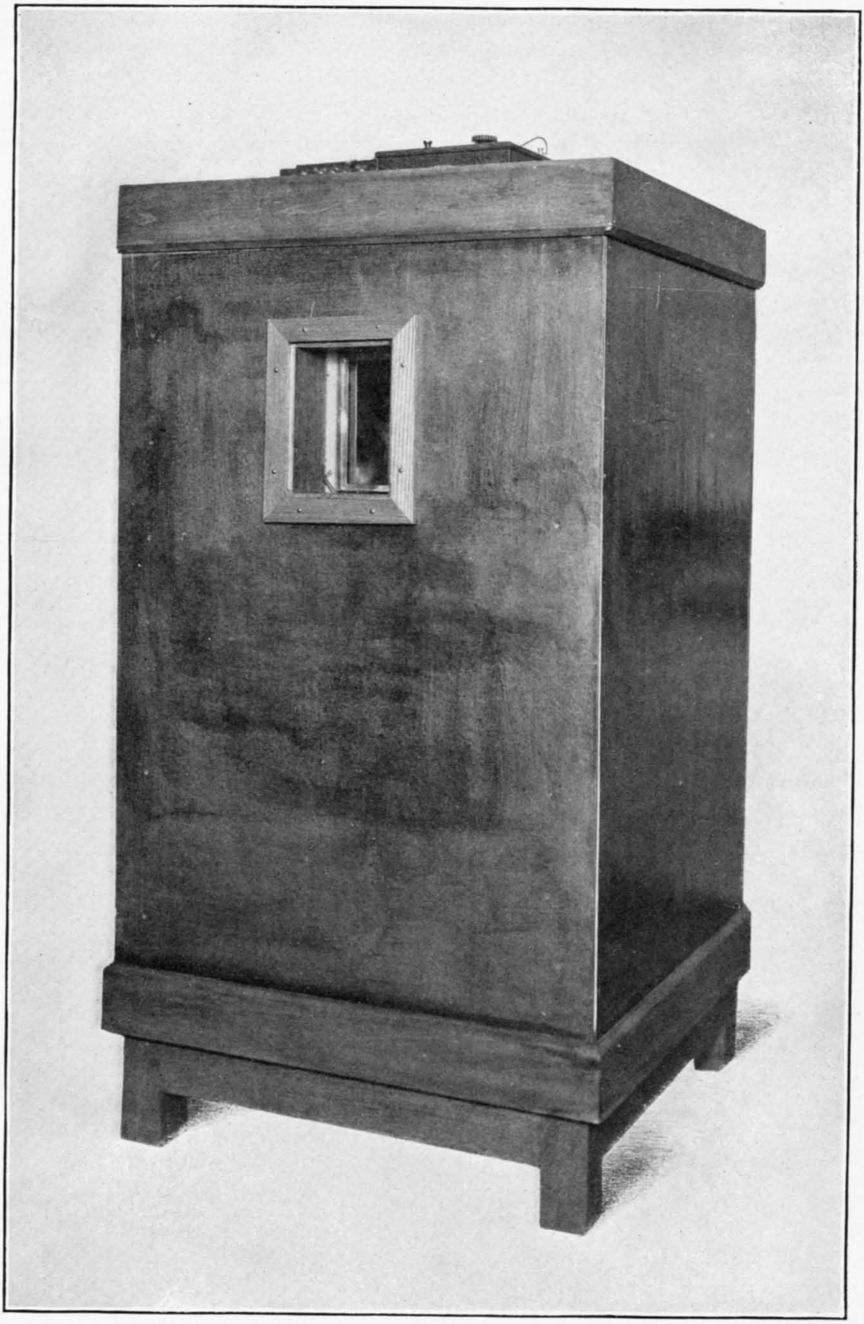
DETAILS OF CONSTRUCTION AND DESCRIPTION OF NEW FEATURES.

The inner or respiration chamber proper consists of a double-walled, air-tight, heat-tight copper box 18 inches by 18 inches by 36 inches, inside measurements. The double walls are separated and supported by a cratelike framework of thoroughly seasoned rock maple. At the top the inner walls of the sides are bent out and down to fit into a groove in the maple frame. The entire top is removable as a cover, and is constructed, like the rest of the chamber, of two copper walls separated and supported by a maple framework. The cover fits snugly into the opening in the chamber and its edges extend out and bend down to fit into the groove mentioned above. This point of contact between cover and sides is hermetically sealed by the use of the so-called "universal wax," which is a compound of beeswax and Venice turpentine.

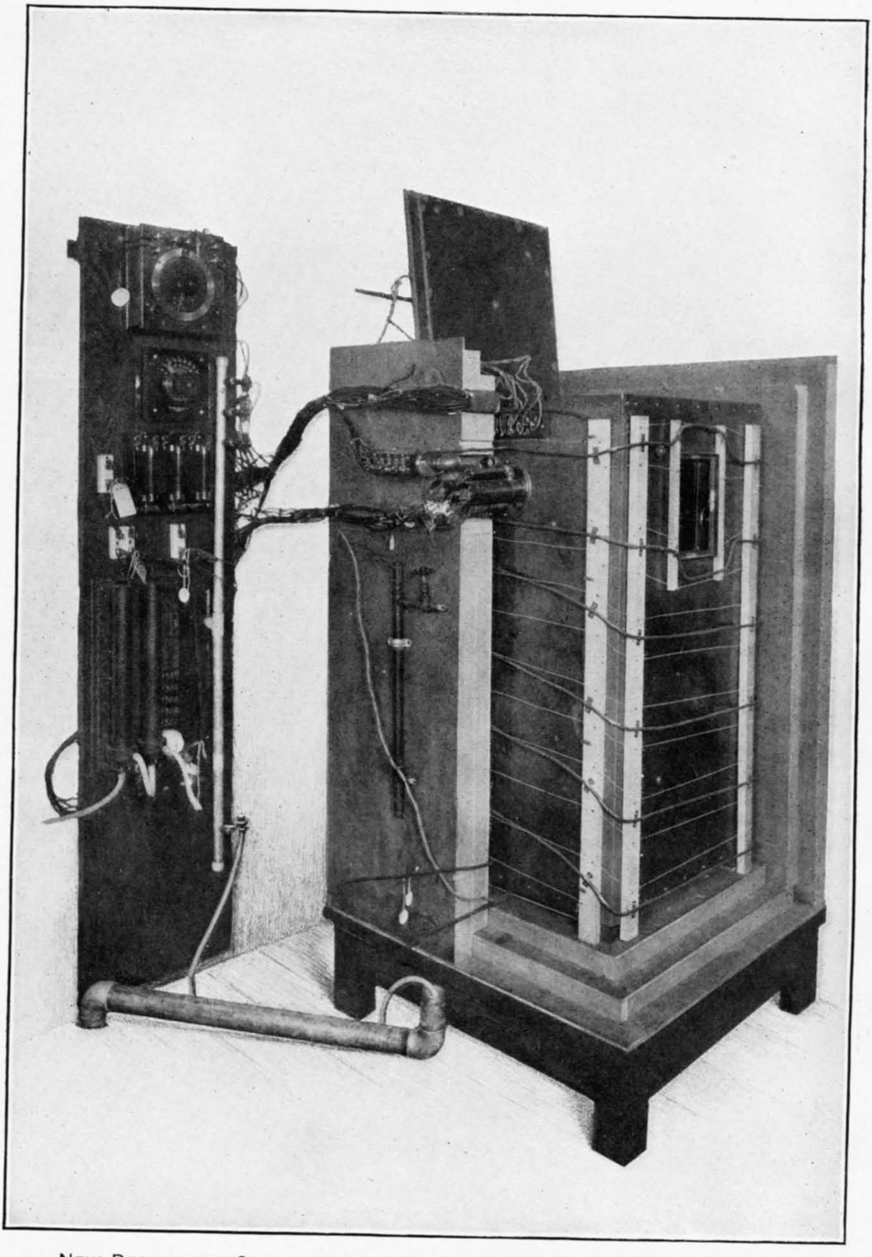
There are apertures in three sides of the chamber located midway of the sides and about 4 inches from the top. The one in front is circular and is lined with a double-flanged tube 3½ inches in diameter, inside measurement. The flange on the inner end of the tube is soldered securely to the inner copper wall. The outer flange is threaded and easily removable. The tube is smooth inside, and into it is fitted closely an "outlet," specially devised to provide openings in the wall into which may be sealed the pipes for the ventilating air current, the water pipes for the heat-absorber system, wires for electrical-resistance thermometers used in the chamber, and for other purposes as needed. The other two apertures are small windows about 5 by 7 inches in size, which are opposite each other on the right and left sides of the apparatus, thus enabling one to view the entire contents of the chamber, which may, if necessary, be lighted by a small electric lamp. The windows are hermetically sealed in place with universal sealing wax, and consequently it is easy to take out either of the windows in order that one may remove a sample of the bananas or other fruits which are being studied whenever this seems desirable. In this way a frequent check may be made upon the rate of the ripening process.

The chamber is designed to accommodate one bunch of bananas of average size suspended from a framework supported on brackets in the corners near the top. Other brackets have also been attached at different levels so that trays, shelves, or other supports may be used; thus it is possible to place under investigation larger or smaller quantities of apples or sweet potatoes or other materials. This material may be packed in the calorimeter in a manner approximating commercial conditions, or, if desired, in some other manner.

Surrounding this respiration chamber and about 1 inch from its outer wall is a heat-insulating covering composed of two layers of cork board 1½ inches in thickness. A prepared lumber one-fourth inch in thickness is used to separate these two layers of cork board and to give a finish to the outer and the inner surfaces. This forms an insulating medium 3¾ inches in thickness surrounding the chamber on all sides. The top, the bottom, and the four sides of the



NEW RESPIRATION CALORIMETER. OUTER PROTECTIVE COVERING IN PLACE.



NEW RESPIRATION CALORIMETER WITH PART OF OUTER PROTECTIVE COVERING REMOVED.

NEW RESPIRATION CALORIMETER. AUTOMATIC DEVICES FOR CONTROLLING TEMPERATURES AND RECORDING TEMPERATURE DIFFERENCES.

protective covering are built up separately. The several sections are joined by double-rabbeted refrigerator-type joints, which insures satisfactory heat insulation and at the same time renders any portion of the calorimeter chamber readily accessible.

On the front side of the apparatus the protective covering is split along the vertical median line, and all wires, pipes, etc., leading to the box pass through openings partly in each of the two sections. Hence, should occasion arise, by lifting off the top section and removing a few screws at the corners, the side sections may be removed very quickly and the entire calorimeter thus be exposed. There are openings in the protective covering to correspond with the apertures in the respiration chamber. The openings for the windows are closed by plate glass, and the circular aperture is heat-insulated by a cork case or box.

The outside dimensions of the chamber when surrounded by the insulating covering are 30 inches by 30 inches by 48 inches, which gives a total height of 55 inches, since the calorimeter rests on a substantial oak platform 30 inches by 30 inches by 7 inches. Thus, there is opportunity for a free circulation of air underneath the calorimeter as well as around and above it.

The outer covering of the apparatus is finished at top and bottom with a strip of wood 3½ inches wide and at the corners with brass angle strips. A strip of wood 1½ inches wide covers the joining of the halves of the protective covering on the front of the calorimeter. These finishing strips, which can be easily removed when necessary, hold the protective covering firmly in place and also add to its appearance.

Plate LXV is a view of the exterior of the respiration calorimeter with the protective covering in place, and shows the window in one side.

Plate LXVI is a view of the respiration calorimeter showing how portions of the protective covering may be removed, as described above. The cold-water pipes for cooling and the resistance wire for heating the exterior side walls of the chamber described above are also shown. The cover of the respiration chamber is raised. On the wall panel are shown switches for various electric currents, the preheater for warming, and the bridge for determining the temperature of the water entering the heat-absorbing system and other devices.

CIRCULATION AND PURIFICATION OF VENTILATING AIR CURRENT.

In the chamber of the larger respiration calorimeter, approximately 4,500 liters in volume, a small electric fan is used to stir the air in order that its temperature and composition may be uniform and homogeneous. This, however, is not usually necessary in the case of the smaller calorimeter, since its total capacity is only about 170 liters; and when it contains a bunch of bananas or an equivalent amount of other bulky fruit, the amount of air present must necessarily be small, and doubtless is kept sufficiently mixed by its passage through the ventilation system. If, however, the amount of air is relatively large, a small fan is used to keep it stirred. The air in the calorimeter is kept in circulation and freed from water vapor and carbon dioxid, which are generated by the ripening fruit, by means of a closed-circuit ventilation system.

The devices for the circulation and purification of the air, arranged in series or "trains," are placed nearby the apparatus on a four-shelved oak table, which is 49 inches high, 39 inches long, and 17½ inches wide. On the bottom shelf is a positive four-bladed rotary compressor for keeping the air in circulation, with a maximum capacity of about 25 liters per minute. A small motor furnishes the power to drive the blower as well as to drive a small gear pump, which keeps in circulation the distilled water flowing in the heat-absorber system. On the third shelf from the bottom are two of the trains for purifying the ventilating air current. This arrangement allows one train to be in use while the other is being weighed and prepared for future use. Valves at either end of the trains permit the ventilating air current to be switched from one train to the other at will. On the top shelf is a meter for measuring the air samples drawn for analysis from the moving air current at certain intervals.

The products of respiration are removed from the air in the closed circuit by forcing the air through the purifying system mentioned above, which is composed of special gas-washing bottles arranged in series. The first two bottles of the train contain sulphuric acid, which removes the water vapor from the air. Following these are two bottles containing soda lime (a granular mixture of caustic soda and quicklime), which removes the carbon dioxid, and then another bottle containing sulphuric acid, which absorbs any water given off from the soda lime. Any traces of sulphuric acid fumes or spray present in the current of air as it leaves the purifying train are removed by the passage of the air through dry sodium carbonate. The first two bottles of this train, containing sulphuric acid for the purpose of removing water vapor from the air current, are weighed as a unit. The next three bottles—two containing soda lime to remove the carbon dioxid from the air, and one containing sulphuric acid to collect any moisture from the soda lime—are weighed as a second unit. By weighing these units of the purifying train at chosen intervals the quantities of water and of carbon dioxid given off by the material under investigation during an experimental period are determined.

In this type of ventilation system, as rapidly as any gaseous substance is removed other gas must be introduced to maintain atmospheric pressure in the chamber. Usually oxygen would be employed, since it is the gas used up by respiration, as the term is generally understood; but in case the fruit were ripened in some inert gas, such as carbon dioxid or nitrogen, this gas would be used instead of oxygen, and the rate of ventilation could be very much reduced or the ventilation even stopped. Methods for admitting gas to the chamber and for collecting air for analysis are similar to those already described in a previous publication[1] in connection with the large calorimeter. The air inside the respiration chamber is maintained at atmospheric pressure by means of an automatic regulating device, with a collapsible diaphragm communicating directly with the chamber.

COLLECTION AND MEASUREMENT OF HEAT LIBERATED IN THE RESPIRATION CHAMBER.

The heat generated by the ripening fruit is removed from the respiration chamber by a stream of water which flows through small copper pipes coiled just underneath the cover of the chamber. For this purpose distilled water is used in the heat-absorbing system, as it has been found that when water from the city main is cooled below the desired temperature and then again raised to a desired constant temperature air tends to collect in bubbles in the pipes, which may form temporary obstructions and thus cause an irregular flow of the water through the heat-absorbing system. In tests already made, using distilled water in the heat-absorbing system, it has been found that the rate of flow is very uniform. In fact, it is so uniform that it is necessary to weigh the water passing through the heat-absorbing system only at relatively long intervals in order to determine the amount of water used during a given experiment, even when it is of several days' duration. From the heat-absorbing system the water flows into a sump located on the second shelf of the table already mentioned. From this sump the water falls to the rotary pump, which elevates it to a glass reservoir on a shelf near the ceiling in the calorimeter laboratory, from which it flows down to the heat absorber. The pump has a capacity at least 20 per cent in excess of the maximum rate of the flow of water through the heat absorber, and this excess of water returns through an overflow pipe in the reservoir back to the sump. By this means the height of water in the reservoir is always that of the top of the overflow pipe, and with

[1] U. S. Dept. Agr., Office Expt. Stas. Bul. 175.

this constant head of water in the reservoir the flow of water through the heat absorber is very regular.

The distilled water flowing from the reservoir to the calorimeter is first cooled below a certain temperature by leading the pipe carrying it through a larger pipe, which contains water at a much lower temperature, after which the distilled water is raised to a desired constant temperature by means of an electric heating device. This device consists of a preheater and of a final heater. The preheater, which is operated manually, has a total capacity of $5\frac{3}{4}°$ C., with a rate of 500 c. c. of water per minute, and heat may be added as needed in small increments. To secure uniformity of temperature the final heater is separated from the preheater by a mixing bottle. The final heater, which is automatic, has a much smaller range than the preheater, but it can be adjusted within very narrow limits. The sensitive portion of the final heater consists of a very delicate electrical resistance thermometer, of a type designed by the United States Bureau of Standards, which comprises one arm of a Wheatstone bridge, the slide wire of which is designed to cover a range of temperature from 0° to 35° C., shown on the dial of the bridge. This thermometer is placed in the water pipe immediately above a small heating coil of electric-resistance wire, so that the water flows from the coil directly over the thermometer. If the temperature of the water flowing over the thermometer differs by 0.05° C. from the desired temperature, at which the pointer of the bridge is set, the needle of the galvanometer with which the bridge is connected is deflected accordingly, and the automatic controller, of which the galvanometer forms a part, alters the position of a sliding contact on a variable resistance which is in series with the heater just below the thermometer. This results in a change in the amount of current through the heater, its heating effect is varied accordingly, and the temperature of the water flowing past the thermometer is regulated until it reaches the desired constant temperature.

The difference in temperature between the ingoing and the outgoing water of the heat-absorbing system within the calorimeter is measured by two differential flow-calorimeter thermometers connected with an automatic recording device such as is being used in connection with the larger calorimeter.[1] One of the thermometers is in the ingoing water, the other in the outgoing water, and both form opposite arms of a Wheatstone bridge. Between the two is the slide wire necessary to restore balance between the two thermometers when there is a temperature difference. This slide wire is incorporated in a mechanism which automatically balances the bridge and at the same time gives a graphic record of the changes of the bridge in

[1] U. S. Dept. Agr. Yearbook 1910, p. 307. U. S. Dept. Agr., Office Expt. Stas. Circ. 116.

terms of temperature difference. This apparatus is sensitive to differences in temperature as small as 0.005° C., but the differences are recorded to 0.01° C. only.

The temperature-recording device here referred to, with its pen drawing a line representing a temperature difference, is shown in the lower right-hand corner of Plate LXVII. Next to this, to the left, is shown the bridge pertaining to this device, by means of which it is possible to vary the range of the records and to test the accuracy of the recording device. Immediately above the recorder is shown a device for automatic control of the temperature of the water that enters the heat-absorbing system of the respiration chamber referred to above. At the left, on the same shelf, is a device which automatically controls the heating of the top, sides, and bottom of the exterior wall of the respiration chamber and of the ingoing air in the circulating air system (see below). The bridge for this device is shown on the shelf immediately below it.

METHODS AND APPARATUS FOR MAINTAINING HEAT EQUILIBRIUM.

In order that the heat given off by the ripening fruit or other material in the chamber may be accurately measured, it is necessary that there be no loss or gain of heat, either through the walls of the chamber or through the moving air current. To accomplish this purpose means are provided for regulating the temperature of the air space between the protective covering and the outer wall of the calorimeter, as well as of the moving air, so that the temperature of the outer wall is kept the same as that of the inner wall, and the temperature of the ingoing air is kept identical with that of the outgoing air. In order to meet this requirement, an automatic controlling mechanism, similar in general characteristics to the controller for the heat-absorbing water line, is used. This controlling device functions separately and successively in four sections, which regulate the heat of the top, sides, bottom, and the moving air, respectively.

The adiabatic condition of these four sections may be maintained either by cooling or by heating, or by both, as found necessary. In practice, it has been found expedient to cool somewhat and continuously and to make the final more delicate regulation by varying the heating alone. The cooling of these several sections is effected by means of cold water passing through small pipes. In the case of the ingoing air current, the water pipe lies for a short distance within the air pipe, just before this enters the calorimeter. In the case of the top and bottom sections, the pipe is soldered in a symmetrical figure to a metal sheet which is placed in the controlled air space, thus distributing the temperature uniformly. In the case of the sides, the pipe encircles the chamber uniformly, and is supported and kept in place by strips at the corners. The water which passes through these small pipes is cooled by means of cold brine from a refrigerating plant.

The heating of the four sections is effected by an electric current passing through resistance wire run parallel to the cooling pipe. In the case of the moving air-current system, a specially designed heater is provided. The resistance wire of the heater is wrapped around the ingoing air pipe just before this pipe enters the chamber. This resistance wire is divided into three parts. One part is connected directly with the automatic controlling device, and either or both of the other two parts may be added if needed. The heater is protected by an asbestos-paper covering about an inch thick. In the case of the top and bottom sections of the calorimeter, the resistance wire is held in place by being wrapped symmetrically around wooden frames. In the case of the sides, the wire encircles the calorimeter and is held in place by means of the same wooden strips which carry the pipes for the cooling water. The amount of current flowing through the resistance wire of these four sections is varied as needed, by the automatic controlling device. Each section of the controller contains a variable rheostat in series with the resistance wire of the corresponding section of the calorimeter. The rheostat of each section of the controller is so arranged as to vary the heating of the corresponding section of the calorimeter by uniform steps. Since the controlling device functions successively and separately on each of the four sections of the calorimeter, if the differential thermometers on any of these sections indicate a difference in temperature the galvanometer needle is deflected. This deflection causes the mechanism to alter the rheostat in series, and hence varies the heating in the section affected.

In order to maintain a desired temperature in the walls of the calorimeter, it is necessary to detect even minute temperature differences between the two metal walls. In the new respiration calorimeter resistance thermometers have been used for this purpose, instead of thermoelectric elements which are used in the larger calorimeter. These thermometers are constructed as flat disks which are screwed firmly against the surface of the copper walls. Between the thermometer and the walls are several folds of very thin tin-foil, so that in case of any bending or buckling in the calorimeter walls the heat contact between the thermometers and the walls is not broken. The thermometers on the inner and the outer walls form opposite arms of the Wheatstone bridge pertaining to the above-mentioned controlling mechanism. They are so sensitive and so quick acting that a temperature difference of 0.01° or less between the two walls immediately causes a deflection of the pointer of the galvanometer, which affects the controlling mechanism so that the heating current for the corresponding section of the walls is increased or diminished according as the outer wall needs heating or cooling. A thermometer in the ingoing air pipe and another in the outgoing air pipe function in the same way for the control of the temperature of the ingoing air.

In order to get an accurate measure of the quantity of heat generated within the calorimeter it is necessary to know whether any heat has been taken up or given off by the walls of the chamber itself. To determine the temperature of the copper wall at the beginning and end of an experimental period use is made of electric resistance thermometers, which are also of the disk type, and are attached directly to the copper wall. Ten such disks, attached at different places to the wall, are combined as a single thermometer and are connected directly with the temperature indicating device, by means of which the temperature of the wall may be determined to 0.1° or even less at any point between 0 and 50°. This enables the apparatus to be used at a very wide range of temperature.

Similarly, in order to determine the quantity of gases evolved within the chamber it is necessary to know the quantities present at the beginning and end of the experimental period. This involves a knowledge of the temperature of the gas in the chamber. For this purpose use is made of a thermometer constructed of resistance wire wound on a long thin strip which may be suspended at any convenient point within the chamber. This thermometer is also read by means of the temperature indicator mentioned above, the wall thermometer and the air thermometer being connected with the indicator by means of a suitable switch. Another thermometer of the type similar to that used for determining the temperature of the air is also used for measuring the temperatures of the fruit within the chamber, and this is likewise connected with the temperature indicator through another point on the switch. This switch may be seen on the wall panel shown in Plate LXVI.

POSSIBLE USES OF THE NEW RESPIRATION CALORIMETER.

The new calorimeter is designed especially for the study of ripening fruit or other vegetable products. However, it is so constructed that the respiration chamber can be removed and another substituted for it, of the same size but with different interior arrangements, or of smaller size, should this be desirable. This would not involve any change in the recording and controlling devices and other accessory apparatus. In other words, it would be possible, with little additional labor, to adapt the apparatus to the study of additional problems, such, for instance, as the incubation of eggs and the changes which take place in curing and storing meat products and cheese, or by making suitable provision for the collection of excretory products and for the comfort of the subjects, it would be possible to adapt the calorimeter to experiments with laboratory animals, should the work of the department make this necessary.

CONCLUSION.

Some of the theoretical considerations regarding ripening fruit have been outlined which led to the attempt to study such questions of plant life by methods which had given good results in the investigation of many topics pertaining to the nutrition and to the energy expenditure of man. It was found that ripening fruit (bananas) could be studied in this way, since when they were kept during the active ripening period in the chamber of the large respiration calorimeter carbon dioxid and water vapor were given off, oxygen was absorbed, and heat liberated, all in measurable quantities. In other words, conditions were present which could be studied with great exactness with the aid of the respiration calorimeter.

It was furthermore apparent from the success which attended this preliminary investigation that many other problems of plant life could be studied by these methods and that results of practical as well as of scientific value could be secured, since a knowledge of the factors studied are of great importance in the consideration of problems which pertain to the handling and storage of fruit in the home and under commercial conditions.

The chamber of the respiration calorimeter used in experiments with man is so large that it will accommodate seven or more large bunches of bananas; that is, its capacity is too great to make it useful except for fruits which can be obtained in uniform condition in fairly large quantities. Furthermore, the entrance to the calorimeter and all its internal arrangements are designed with reference to experiments with man and are not particularly well suited to experiments with vegetable products. It was obvious, therefore, that a small calorimeter with special equipment suited to experiments with plant products would be a great convenience, and in view of the fact that it would be useful for the study of a large variety of problems of interest to the department, such an instrument was constructed. In principle and plan it corresponds to the large calorimeter used for experiments with man, although some improvements in grouping of accessory apparatus have been introduced and some new regulating devices which greatly lessen the labor of conducting the experiments have been added which make for greater accuracy.

The nutrition laboratory of the Office of Experiment Stations is well equipped with respiration calorimeters of great accuracy, and is engaged in the study of a variety of problems of interest to the Department of Agriculture, coöperating with other bureaus when this seems desirable.

APPENDIX.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE.

Secretary of Agriculture, JAMES WILSON.
Assistant Secretary of Agriculture, WILLET M. HAYS.
Chief Clerk, C. C. CLARK.
Solicitor, GEORGE P. McCABE.
Appointment Clerk, R. W. ROBERTS.
Supply Division, CYRUS B. LOWER, *Chief*.
Weather Bureau, WILLIS L. MOORE, *Chief*.
Bureau of Animal Industry, ALONZO D. MELVIN, *Chief*.
Bureau of Plant Industry, BEVERLY T. GALLOWAY, *Plant Physiologist and Pathologist and Chief*.
Forest Service, HENRY S. GRAVES, *Forester and Chief*.
Bureau of Chemistry, ——— ———, *Chemist and Chief*.
Bureau of Soils, MILTON WHITNEY, *Soil Physicist and Chief*.
Bureau of Entomology, L. O. HOWARD, *Entomologist and Chief*.
Bureau of Biological Survey, H. W. HENSHAW, *Biologist and Chief*.
Division of Accounts and Disbursements, A. ZAPPONE, *Chief and Disbursing Clerk*.
Division of Publications, JOS. A. ARNOLD, *Editor and Chief*.
Bureau of Statistics, VICTOR H. OLMSTED, *Statistician and Chief*.
Library, CLARIBEL R. BARNETT, *Librarian*.
Office of Experiment Stations, A. C. TRUE, *Director*.
Office of Public Roads, LOGAN W. PAGE, *Director*.

PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE AND HOW THEY ARE DISTRIBUTED.

By JOS. A. ARNOLD, *Department Editor*.

The publications of the United States Department of Agriculture may be divided into three general classes, as follows:

(1) Annual reports, comprising the Yearbook, Annual Reports Department of Agriculture, Report of the Bureau of Animal Industry, Report of the Office of Experiment Stations, Field Operations of the Bureau of Soils, Report of the Weather Bureau.

These publications are distributed mainly by Senators, Representatives, and Delegates in Congress, although a limited number of copies is always allotted to the department. For instance, of the 500,000 copies of the Yearbook the departmental quota is only 30,000, the remaining 470,000 being reserved for distribution by Members of Congress. The department's supply of publications of this class is reserved almost exclusively for distribution to its officers and special correspondents in return for services rendered, and to libraries, but miscellaneous applicants can usually obtain these documents from some Senator, Representative, or Delegate in Congress.

(2) Bureau bulletins and reports. Of these each bureau, division, and office has its separate series in which the publications are numbered consecutively as issued. They are generally of a scientific or technical character.

The publications of this class are not for distribution by Members of Congress, nor are they issued in editions large enough to warrant wide general distribution by the department. The supply is mainly distributed to small lists of persons who cooperate with or are especially interested in the work of the bureau, division, or office in which the publication originated, or who are rendering some service, and to educational and other public institutions, including libraries. The department is frequently obliged to refer other applicants to the superintendent of documents, Government Printing Office, who is authorized by law to sell all Government publications. In accordance with a provision in the act of January 12, 1905, editions of publications containing more than 100 pages are restricted to 1,000 copies.

(3) Farmers' Bulletins, circulars, extracts, and other popular papers. These publications are written in plain language, and treat in a practical way of subjects of particular interest to persons engaged in agriculture and kindred pursuits. A special appropriation is made by Congress for the publication of Farmers' Bulletins, and they are issued in large editions and are designed for free general distribution by the department.

The Farmers' Bulletins are also for distribution by Senators, Representatives, and Delegates in Congress, each of whom is furnished annually, according to law, with a quota of 12,500 copies for distribution to his constituents. Four-fifths of all such bulletins printed, with the amount specially appropriated for the purpose, are distributed in this way, leaving only one-fifth of them for distribution by the Secretary. It is frequently necessary to refer applicants for these publications in quantities to their Senators, Representatives, or Delegates in Congress, because of the insufficiency of the department's allotment to supply the large and increasing demands for the bulletins.

The scientific and technical publications, embodying the results of the researches of the department's scientists, constitute the foundation of many of the popular publications, and are larger in size and more expensive.

All of the publications of the department are distributed to miscellaneous applicants as long as the supply will permit. If the demand continues, and funds are available for the purpose, reprints are issued and the distribution continued, care being taken to supply applicants with only the publications that are likely to be of particular value to them, the issuing bureau, division, or office being freely consulted with regard to the distribution of the strictly scientific and technical publications.

When the supply of a bulletin is exhausted and there are no funds available for securing additional copies, applicants are referred to the superintendent of documents, Government Printing Office, who, under the law of January 12, 1895, is authorized to sell all Government publications at a nominal price. He is also authorized by law to reprint, with the approval of the Secretary, new editions of department publications so long as the demand for them continues, the money received from the sales being used to pay for reprints. This applies to all classes of publications, and application should be made to the superintendent of documents, Government Printing Office, Washington, D. C., accompanied by cash, postal money order, express order, or draft, covering the amount of the charge. The department is of necessity frequently obliged to refer applicants to this official because of its inability to supply them with the publications they desire to receive.

The Secretary of Agriculture has no voice in designating the public libraries in which all publications and documents shall be deposited. These libraries are designated by Members of Congress, and the distribution of public documents to such depositories, including the publications of this and other departments of the Government, is a function of the superintendent of documents. The department maintains a list of libraries which are not public depositories to which the publications of the department are sent as issued. All publications of the department, therefore, are readily available for reference in almost every library in the United States.

The department has no list of persons to whom all of the publications are sent, as this method of distribution has been found to be wasteful and unsatisfactory.

The Monthly List of Publications, dated the last day of each month, contains full information with regard to the publications issued that month and how the same may be obtained. It is sent regularly to all who ask to have their names placed on the list to receive it. The department also issues circulars, one for each bureau, division, and office, giving complete lists of the publications available for distribution, including lists of new Farmers' Bulletins. These circulars are reprinted from time to time and sent to all who apply for them.

Applicants for publications are urged to select only a few bulletins or circulars in which they are particularly interested, it being the policy to send some publications to every applicant rather than many of the publications to a few applicants.

The work of distributing the department publications, of whatever character, excepting those issued by the Weather Bureau and those sold by the superintendent of documents, is performed by the Division of Publications.

Publications of the State agricultural experiment stations are not distributed by the United States Department of Agriculture. Applications for them should be addressed to the director of the station in the respective States.

Applications for the publications of the Department of Agriculture should be addressed to the Secretary of Agriculture, Washington, D. C.

REVIEW OF WEATHER CONDITIONS DURING THE YEAR 1911.

By P. C. Day, *Climatologist and Chief of Division, Weather Bureau.*

The following summary of the weather for 1911 conforms largely with that appearing in the several numbers of the National Weather Bulletin, issued by months during January, February, March, October, November, and December, and by weeks during the principal crop-growing period, April to September, inclusive.

The feature of the year's weather that stands out most prominently in its effects upon the well-being of the people during the year, and that will doubtless serve as a standard of comparison for many years to come, was the long and excessively heated period that prevailed over most of the districts east of the Rocky Mountains from the early part of May to the early part of July. During this period of slightly more than two months a series of hot waves of marked severity, for so early in the season, followed one another in such rapid succession as to produce an almost continuous period of heat not surpassed for intensity or duration in many years.

The effects of this continued heat were most pronounced over the more northern portions of the country, where in the congested parts of the great centers of population the suffering was intense, and thousands of deaths resulted from the direct effect of the severe heat.

Lack of sufficient rainfall over much of the country during the same period, together with the extreme heat, threatened a serious curtailment of the great cereal crops and greatly retarded the growth and development of small fruits, vegetables, and grasses.

A change to cooler weather near the end of the first decade of July greatly relieved the suffering of human and animal life, and opportune rains about the same time proved so beneficial to growing crops that only in restricted areas was the output of the principal crops materially reduced over that of previous years.

In marked contrast with the heated condition over eastern districts referred to above, to the west of the Rocky Mountains the late spring and early summer were unusually cool; frosts occurred at unusually late dates and vegetation was backward. With the change to cooler weather in the eastern districts during the early part of July, warmer weather set in over the region west of the Rocky Mountains and more seasonable temperatures obtained during the balance of the season, but for the crop-growing season as a whole the temperatures over the more western districts were unusually low.

January.

Temperature.—A rather severe cold wave overspread the Northwest and moved into the southern and eastern districts during the first few days of the month. This cold was especially severe over the west Gulf States, including Texas, where even along the coast it was 10° or more below the freezing point, causing considerable damage, especially in southern Texas and also in portions of Florida.

The weather continued cold over the interior and northern portions of the country until about the 15th, when warm weather set in, after which, until the close of the month, no severe cold occurred in any part of the country.

Precipitation.—The precipitation was generally light in the districts from the middle and southern plains region eastward to the Atlantic, the deficiency in portions of Texas, Oklahoma, the lower Mississippi Valley, and South Atlantic and east Gulf States ranging from 2 to 4 inches.

Over the greater part of the plateau region and in California there was generally more than the average amount of precipitation, especially in California, where the excess ranged from 4 to 8 inches or more, and thoroughly broke the long drought that had prevailed in that State.

Snow.—The snowfall was generally light over the districts from the Rocky Mountains eastward, and there was as a rule but little snow covering in the winter-wheat districts.

In the Rocky Mountains and in portions of the plateau district there was generally less snow than usual, but in the Sierra ranges, especially in California, the snowfall was much heavier, and the high ranges at the end of the month were covered to an unusual depth.

February.

Temperature.—No marked cold waves occurred during the early part of the month, but cold weather set in on the 19th and 20th over all districts between the Rocky and Appalachian Mountains.

This cold wave continued until about the 23d, and during that time extended to nearly all portions of the country, causing considerable damage over the southern districts, especially as the preceding weeks had been unseasonably warm and vegetation had advanced to an unusual extent.

After the above date warmer weather prevailed in most districts, save in the Northwest, where the cold continued.

The month as a whole was comparatively warm throughout the central and most of the eastern districts, but was colder than the average over nearly all districts from the Rocky Mountains westward.

Precipitation.—The precipitation was unusually heavy over portions of the southern plateau region and thence eastward over much of the country to the middle Mississippi and lower Ohio Valleys and northern portions of the Gulf States, and the severe drought that had prevailed over much of Texas was greatly relieved.

Rainfall was sufficient over much of the interior and southern portions of the cotton-growing States and over the greater part of the Atlantic coast districts, as well as in the extreme Northwest. The need of more rain was beginning to be seriously felt in portions of Florida and Georgia, where but little moisture had fallen for several months.

Snow.—The snowfall was comparatively heavy in the Rocky Mountain regions and the accumulated supply in the high ranges had increased sufficiently to indicate a good supply of water for irrigation in the districts depending thereon.

Over the Sierra Nevada and adjoining ranges there was generally less than the usual amount of snow, but the heavy falls of the preceding month still remained largely unmelted, especially in California, thus assuring a plentiful supply of water for the coming crop season.

There was generally less snow over the eastern districts than usual, except in portions of the Lake region, and the greater part of the winter-wheat belt was unprotected during much of the month, although during the severest cold there was a moderate covering of snow in many portions.

MARCH.

TEMPERATURE.—With the opening of the month warm weather developed over the Northwest, the temperature increasing slowly over nearly all interior districts as the month advanced, until about the 15th, when a change to colder weather occurred over the Northwest. This cold area advanced eastward and became quite pronounced in the Middle and South Atlantic States, where the coldest weather since the preceding December occurred at many points, and frosts occurred in northern Florida.

Some cold weather occurred during the third decade, but as a whole the month was an unusually warm one throughout the entire interior portions of the country, the temperature averaging from 6° to 12° per day above the normal over much of the Great Plains and Rocky Mountain regions.

PRECIPITATION.—There was a decided deficiency in precipitation over much of the country, the only section receiving a marked excess being near the coast of southern California, where the monthly amounts ranged from 2 to 7 inches above the normal.

Some good rains occurred over eastern and southern Texas, where additional moisture was much needed, but there was a marked deficiency in the great central valleys and over much of the cotton belt, especially in the more eastern districts.

SNOW.—Small amounts of snow occurred during the month over the northern districts and at the end the ground was still covered by several inches of snow in portions of New England, New York, and other far northern States.

Under the influence of moderately warm weather with little rain the melting of the accumulated snow over the northern districts was accomplished so gradually that no serious floods occurred, the water passing into the ground and leaving it in generally excellent condition for the usual spring operations.

In the mountain districts of the West the snow melted quite rapidly over the southern districts, giving an abundant supply of water, while in the northern districts it melted more slowly, thus assuring a good supply of water for the latter part of the season.

APRIL.

TEMPERATURE.—Near the first of the month temperatures were low for the season over nearly all districts, and especially so in the southern Appalachian Mountain region, where killing frosts occurred, and temperatures below zero were reported from the northern portions of New York and New England.

It was unusually warm about the middle of the first decade in the Gulf States, but colder weather followed and by the end of the decade the cold area had overspread the central and eastern districts with temperatures near zero in the upper Missouri Valley and heavy frosts as far south as North Carolina.

The average temperature for the first 10 days was considerably below the normal throughout the Great Plains region and over all northern districts, but it was correspondingly above the normal in the South Atlantic and east Gulf States and over the Florida Peninsula.

During the second decade cool weather was the rule over much of the country, especially in the Rocky Mountain and plateau districts, over the Appalachian Mountain region, and eastward to the Atlantic coast.

During the last decade cool weather continued to the westward of the Rocky Mountains, especially over the Pacific coast States, while to the eastward there were decided fluctuations, cold weather generally predominating, with occasional freezing temperatures, and frosts in the more exposed localities.

No great amount of damage occurred, however, from these low temperatures on account of the backward state of vegetation, the development of which had been much retarded by the continued unfavorable weather.

PRECIPITATION.—For the month as a whole there was much rainy and unfavorable weather over the great agricultural regions, especially in the corn-growing States and in the middle and northern portions of the cotton region.

Dry weather continued over much of Florida and portions of Georgia; in the spring-wheat belt the precipitation was generally somewhat deficient, and there was a very general lack of the usual amount of rain in the plateau and Pacific coast States.

SNOW.—On account of the continued cool weather the snow in the mountain regions of the West continued to melt slowly, thus further conserving the water for use later in the season.

MAY.

TEMPERATURE.—Marked variations occurred in the temperature conditions during the month and extremes of both heat and cold were broken at many points.

The first week of the month was abnormally cool from the plains region eastward, the deficiency ranging from 6° to 9° per day over much of the Mississippi Valley and adjoining districts. At the same time comparatively warm weather prevailed in the plateau and northern mountain districts.

At the beginning of the second week temperatures began to rise in the Great Plains region, and as the week advanced the warm wave overspread the entire eastern portion of the country, giving the warmest weather of the season to date.

West of the Rocky Mountains the weather continued cold during the week, and toward the end cooler weather had extended to the districts to the east of the mountains. This change to cooler weather was but temporary, however, and warm weather again overspread the eastern districts, continuing with little interruption until near the end of the month. In portions of the Mississippi Valley and in the districts to the eastward the temperatures during the last two weeks of the month were in many cases unprecedented in May for both intensity and duration of the heated period.

West of the Rocky Mountains the weather continued cold and in striking contrast with the conditions to the eastward. On several dates when intense heat was prevailing in eastern districts temperatures below freezing and snow were observed in the mountain, plateau, and far northwestern regions.

PRECIPITATION.—With the advent of the heated period over the eastern districts dry weather set in and but little rain occurred during the month over large portions of the great agricultural districts. At the end of the month severe drought prevailed in the eastern portion of the cotton belt and the severe heat and continued dry weather over much of the Great Plains region from Texas northward had proved very trying to vegetation.

In the Atlantic coast States there was a marked deficiency in precipitation, the growth of vegetation was much retarded, and the continued deficiency in precipitation had materially reduced the water supply of the large cities and threatened serious interference with manufacturing interests depending upon water for power.

West of the Rocky Mountains considerable rain fell over the more northern districts and along the coast from northern California to Washington, but over the remaining districts there was little or no rain, although the supply of water for irrigation was generally abundant.

June.

Temperature.—A slight respite from the severe heat over the districts east of the Rocky Mountains occurred near the end of May and continued in portions of the more eastern districts for the first few days of June, but warmer weather again developed over the Northwest, and during the 3d, 4th, and 5th of the month extremely high temperatures were again the rule over portions of the Great Plains and Mississippi Valley.

With the exception of slight breaks of a few days' duration unusually warm weather continued throughout June over much of the country east of the Rocky Mountains, the period of greatest heat occurring about June 24–26, when maximum temperatures in the Great Plains region, especially in Kansas and Oklahoma, and the adjoining portions of surrounding States were above 100° over large areas, reaching 110° at numerous points, with an extreme record of 116° in north-central Kansas.

Much suffering occurred during the periods of extreme heat, especially in the large cities of the Northern States, where the heat was more severe than farther south.

The temperature for the month was far above the normal over all the interior portions of the country, the average excess in the Great Plains and portions of the Mississippi Valley ranging from 4° to 8° per day. A small area, including portions of New York and New England, had average temperatures near or slightly below the normal, while to the westward of the Rocky Mountains the weather remained moderately cool throughout the greater part of the month and the season continued unusually backward, especially in the far Northwest.

Precipitation.—The dry weather that had set in over many sections during May continued into June, becoming more or less serious as the month advanced. Some districts received timely showers, but for the month as a whole the precipitation was nearly everywhere far below the seasonal average. The deficiency was most marked, however, in the middle and southern portions of the Great Plains and in the lower Missouri and middle Mississippi Valleys, where only a small per cent of the usual fall for the month occurred. In portions of the South Atlantic and East Gulf States also there was a marked deficiency.

At the end of the month severe drought was prevalent over the western portion of the corn belt, being especially severe in Oklahoma and portions of Kansas, Missouri, and other States to the west of the Mississippi.

In the corn-growing States south of the Ohio River drought prevailed during much of the month, especially in Kentucky and Tennessee, where it was the most severe in many years. In the corn-growing States north of the Ohio River local showers occurred, and conditions were more favorable.

In the cotton-growing States drought continued in Texas and Oklahoma, where the precipitation was far below the normal, and in some sections of those States little or none occurred during the entire month. There was a considerable deficiency in precipitation over the more eastern States of the cotton belt, especially in Georgia, where in some of the central and southern portions the drought was the most severe in many years.

In the spring-wheat region good showers occurred in most districts, except in portions of South Dakota, where at the end of the month the lack of rain was being severely felt.

July.

Temperature.—During the first 10 or 12 days of July the remarkable heat in the Middle and Northern States east of the Rocky Mountains continued; indeed, it reached its culmination in parts of the area affected. Temperatures above 110° occurred at a number of points in Nebraska, Kansas, Missouri, and Iowa, while in parts of New England the temperature reached the highest marks recorded since authentic records were begun. At the same time the Rocky Mountain region and the States to westward were, as a rule, experiencing unseasonably cool weather.

From the 15th or somewhat earlier to the end of the month conditions generally were reversed, and Idaho, Nevada, and the Pacific States had temperatures above the normal, while the Plains States, Mississippi Valley, and eastern districts were cooler than usual in summer.

For the whole month the temperature in the lower lake region, New York, and New England averaged several degrees above normal, owing to the intense heat of the first portion. Oregon and parts of adjoining States likewise averaged somewhat hotter than usual. The most notable deficiency of temperature was in portions of the southern Rocky Mountain and plateau regions.

PRECIPITATION.—The first decade of July brought generous rains to large parts of the central and east Gulf States, and gave irregularly distributed showers to the States to northward, where droughty conditions generally obtained and were intensified by the severe heat. During the middle and latter portions of the month better distributed rains, usually ample in amount, fell over the Middle and Northern States east of the Mississippi River and in North Dakota, Minnesota, and eastern Iowa, while in the South Atlantic and Gulf States there was usually quite heavy rainfall, especially about the middle of the month.

For July as a whole the precipitation was ample over the greater part of the region to eastward of the Mississippi; also over nearly all the area of the western cotton States. The rainfall was scanty, however, in much of New York and Pennsylvania and in large portions of North Carolina and the Ohio Valley; also in lower Michigan, southeastern Wisconsin, and southwestern Texas. There was, on the other hand, excessive rainfall in parts of northern Wisconsin and upper Michigan, southeastern Kansas, and especially over the greater portion of Louisiana, southern Mississippi, and extreme eastern Texas. Droughty conditions continued to prevail, in spite of partial relief, in the western part of South Dakota, western Iowa, and much of Nebraska; but Minnesota and the eastern parts of the Dakotas were more favored. In the southern Rocky Mountain region and in Arizona considerable rain occurred, especially in the vicinity of Phoenix, where almost 5 inches (more than half of the normal annual precipitation) fell within 24 hours on the 1st and 2d. In nearly all other regions west of the Rockies the usual summer dry weather prevailed.

AUGUST.

TEMPERATURE.—In the Middle Atlantic and New England States, the upper Ohio Valley, and especially the lower lake region the first week in August was warmer than normal, and generally throughout the great interior valleys the 7th to 10th was marked by decidedly hot weather, which extended on the 10th and 11th to the Northeastern States. About this time hot weather was prevailing in Texas, especially the southwestern portion, and continued till about the 25th, extending during the 15th to 20th to practically all parts of the Plains States. About the 21st decidedly cool weather set in over the upper Missouri Valley, and continued till about the 29th, with frosts and freezing temperatures occurring in large portions of Montana and Wyoming, and less widely in some adjoining States. From the 27th to the close of the month the cooler weather was felt over most districts to southward and eastward, though only in moderate degree. Abnormally cool weather prevailed during most of August in the interior of California, notably in the Sacramento Valley.

PRECIPITATION.—The first week of August brought generous and well-distributed rains to nearly all the country to eastward of the Great Plains, except Texas and western Louisiana, of which only small portions were favored, and New England, with most of New York and New Jersey. The remainder of the month was characterized by more local precipitation. About the middle of the month almost the whole of the Gulf coast region was visited by heavy rains; likewise South Carolina and southern Georgia in the closing days received torrential rains, when a small but vigorous hurricane moved slowly westward from the Atlantic Ocean into Georgia. The precipitation of August as a whole was generally ample in the districts to eastward of the Rockies; also in small parts of Arizona and much of Colorado and New Mexico; the chief exceptions being large portions of Iowa, Illinois, Indiana, Michigan, and Texas. The rainfall totals were large in several districts besides those already named as receiving excessive falls. The Middle Atlantic States south of New York, southeastern Missouri, eastern Arkansas, and northern Mississippi had far more than their normal monthly amounts.

September.

Temperature.—The first 10 days of September were not marked by notable abnormalities of temperature, except in Montana, Idaho, eastern Oregon, and northern Nevada, where from the 5th to 10th rather cool weather prevailed. In the second decade a short cool spell visited the northeasternmost States, causing, about the 14th, unseasonably low temperatures and damaging frosts in most of New England, New York, and northern interior Pennsylvania. But this middle decade was marked by decided warmth throughout the southern and middle portions of the country between the Rocky and Appalachian Mountains. The last 10 days brought a continuation of warm weather in the east Gulf States and the southern Appalachian region, while to westward of the Mississippi River the change to less hot weather was but slight. However, in Montana and adjoining States cool weather prevailed from about the 21st to 25th, and the northern portion of the country eastward to the lower lakes felt the same cool weather during the last week of the month.

Precipitation.—During the first week of September there was much rain in Montana and the Dakotas, and about the middle of the month in the Ohio Valley and Middle Atlantic States, the falls in the upper Ohio Valley being decidedly heavy. From about the 15th to 21st excessive rains fell in southwestern Missouri, southeastern Kansas, most of Arkansas, and much of Illinois and Indiana. During the last few days of the month heavy rainfall occurred again in Illinois and Indiana, and at the same time the lake region, Iowa, Kansas, western New Mexico, much of Arizona, and most of Utah had large amounts. In Utah the rains were highly beneficial. In parts of southern California, notably the vicinity of Los Angeles, there were quite heavy rains, the fall at Los Angeles on the 28th and 29th, 1.23 inches, being the heaviest ever recorded there in September.

In most of the districts mentioned above the total rainfall of September was decidedly greater than normal, and this was especially true of portions of Illinois and adjoining States. The average fall for Illinois was larger than in any previous month since widespread observations began. In the Willamette Valley and Cascade Mountains the precipitation of September was unusually large. As a whole, the regions of the country not yet named had less rainfall than usual in September, and at the close of the month conditions were dry in much of Oklahoma and central Texas and in some other districts.

October.

Temperature.—The opening days were marked by warm weather in most central and eastern districts, especially in the Southeastern States. About the 7th to 9th a short cool spell visited the more northern districts from the Dakotas eastward, and about the 14th another was felt in the lake region and New England. As a rule, however, the weather was moderately warm between the Atlantic and the Rockies till the 19th or 20th, when cold weather set in over the Rockies and slowly extended eastward.

Precipitation.—During the first week there were heavy rains in the lower Missouri and middle and upper Mississippi Valleys, the falls in northwestern Wisconsin being remarkably large; also in northwestern New Mexico and adjacent parts of Colorado and Arizona excessive rains and floods occurred. About the 17th to 23d there was much rain in southeastern New York and the western parts of Connecticut and Massachusetts; also at this time and during the last few days there were heavy rains in South Carolina and eastern Georgia. For October as a whole the precipitation was above normal in most of the districts named above, and, indeed, in nearly all States east of the Mississippi, besides most of Nebraska, eastern South Dakota, southern Minnesota, and northern and western Iowa. In most of Texas, Louisiana, and Arkansas, and in nearly all of Nevada and the Pacific States the precipitation was scanty.

Snow.—Considerable snow fell in the northern Rocky Mountain region, especially in parts of Montana; but in most other districts there were no snows of importance.

November.

Temperature.—At the opening of the month cold weather had just set in over the upper Missouri Valley, whence it soon spread eastward and southward to the Atlantic and Gulf coasts. Warmer days followed in most of these regions, and by the 10th to 12th it was quite warm for the season in the central valleys and thence eastward. Severe cold, however, was again prevailing in Montana by the 8th, and it spread first to the southwestward, but later to the eastward, bringing, about the 12th or 13th, a marked cold wave in most Central and Eastern States, the temperature fall within 24 hours being 60 to 70° or more in portions of Iowa, Missouri, Illinois, and other States. Unseasonably cold weather was the rule in most districts during the remainder of November, though portions of the Gulf States were warmer than normal till after the 20th, and some Atlantic and Pacific coast districts during nearly all the month. Especially cold weather prevailed from the 23d to 26th in the central valleys and east Gulf States, and in the Gulf and South Atlantic States at the very close of the month. Freezing temperatures and killing frosts at this time did much damage in parts of Texas and Florida, which seldom suffer so early in the season. The upper Missouri Valley experienced unseasonably cold weather almost constantly in November, notably about the 8th to 15th.

Precipitation.—Storms were unusually numerous during November, yet few localities experienced remarkably heavy falls from any single storm; but for the month as a whole the precipitation was somewhat more than normal generally to the eastward of the Mississippi; also in Louisiana and small parts of Texas, most of Missouri, and in the northern Rocky Mountain and plateau regions. Scanty precipitation was the rule in Oklahoma, northern Texas, and the Pacific Coast States.

Snow.—In Idaho, Utah, Colorado, and New Mexico the snowfall in the mountains was about as heavy as usual in November, and in Wyoming and Montana it was somewhat heavier. The Northern States from the Dakotas to Michigan had more than the normal amount of snow, and in North Dakota the ground was constantly covered and at times railroad traffic was seriously interrupted.

December.

Temperature.—Cold weather prevailed during the opening days in the Southern States, but otherwise the first 20 days of the month were warmer than normal almost everywhere east of the Rockies, save in Texas. Decidedly warm weather prevailed about the 8th to 15th east of the Mississippi River, notably in the New England States and the lake region. About the 23d a change to colder was noted in Montana, whence it spread slowly southward and eastward, though the Atlantic States felt but little change before the close of December. In the central part of the Rocky Mountain region the first decade was mild, but west of the Rockies abnormal cold marked nearly the whole month in most districts. In the State of Washington, however, the weather was generally mild till near the end.

PRECIPITATION.—During the first 10 or 12 days there was but little precipitation, but afterwards the cotton States had almost constant rains, usually heavy, so that the monthly totals were generally much above normal. The region of greatest excess included Louisiana and Mississippi with portions of adjoining States. In most of the Ohio Valley and in a few other northern districts east of the Mississippi River the month's totals exceeded the normal; while in most of Missouri, Kansas, and Iowa, eastern Nebraska, and southern Minnesota there was also a considerable excess of precipitation. In the Rocky Mountain region and to westward there was almost everywhere a deficiency of precipitation, save where heavy snows occurred.

SNOW.—From the upper lakes westward there was considerable snow, and the ground was generally well covered. In the Northeastern States, however, there was unusually little snow for December. In the mountain regions of the West the snowfall was about normal in northern districts, somewhat below normal in most middle districts, and varying in amount, though generally above normal, in southern districts. The accumulated amounts at high levels were, as a rule, somewhat above the average. There was unusually heavy snowfall in western South Dakota, southeastern Colorado, western Kansas, and over much of Oklahoma.

AGRICULTURAL COLLEGES IN THE UNITED STATES.[1]

College instruction in agriculture is given in the colleges and universities receiving the benefits of the acts of Congress of July 2, 1862, August 30, 1890, and March 4, 1907, which are now in operation in all the States and Territories, except Alaska. The total number of these institutions is 67, of which 65 maintain courses of instruction in agriculture. In 23 States the agricultural colleges are departments of the State universities. In 16 States and Territories separate institutions having courses in agriculture are maintained for the colored race. All of the agricultural colleges for white persons and several of those for negroes offer four-year courses in agriculture and its related sciences leading to bachelors' degrees, and many provide for graduate study. About 60 of these institutions also provide special, short, or correspondence courses in the different branches of agriculture, including agronomy, horticulture, animal husbandry, poultry raising, cheese making, dairying, sugar making, rural engineering, farm mechanics, and other technical subjects. The officers of the agricultural colleges engage quite largely in conducting farmers' institutes and various other forms of college extension. The agricultural experiment stations with very few exceptions are departments of the agricultural colleges. The total number of persons engaged in the work of education and research in the land-grant colleges and the experiment stations in 1911 was 7,262; the number of students (white) in interior courses in the colleges of agriculture and mechanic arts, 45,871; the total number of students in the whole institutions, including students in correspondence courses and extension schools of five days or longer, 196,528; the number of students (white) in the four-year college courses in agriculture, 8,488; in short and special courses, 10,767; the total number of students in the institutions for negroes, 8,138, of whom 2,257 were enrolled in agricultural courses. With a few exceptions, each of these colleges offers free tuition to residents of the State in which it is located. In the excepted cases scholarships are open to promising and energetic students; and, in all, opportunities are found for some to earn part of their expenses by their own labor. The expenses are from $125 to $300 for the school year.

[1]Including only institutions established under the land-grant act of July 2, 1862.

Agricultural colleges in the United States.

State or Territory.	Name of institution.	Location.	President.
Alabama	Alabama Polytechnic Institute	Auburn	C. C. Thach.
	Agricultural School of the Tuskegee Normal and Industrial Institute.	Tuskegee Institute	B. T. Washington.
	Agricultural and Mechanical College for Negroes.	Normal	W. S. Buchanan.
Arizona	University of Arizona	Tucson	A. H. Wilde.
Arkansas	College of Agriculture of the University of Arkansas.	Fayetteville	C. F. Adams.[1]
	Branch Normal College	Pine Bluff	F. T. Venegar.
California	College of Agriculture of the University of California.	Berkeley	E. J. Wickson.[1]
Colorado	The State Agricultural College of Colorado.	Fort Collins	C. A. Lory.
Connecticut	Connecticut Agricultural College	Storrs	C. L. Beach.
Delaware	Delaware College	Newark	G. A. Harter.
	State College for Colored Students	Dover	W. C. Jason.
Florida	College of Agriculture of the University of Florida.	Gainesville	J. J. Vernon.[1]
	Florida Agricultural and Mechanical College for Negroes.	Tallahassee	N. B. Young.
Georgia	Georgia State College of Agriculture.	Athens	A. M. Soule.
	Georgia State Industrial College	Savannah	R. R. Wright.
Hawaii	College of Hawaii	Honolulu	J. W. Gilmore.
Idaho	College of Agriculture of the University of Idaho.	Moscow	W. L. Carlyle.[1]
Illinois	College of Agriculture of the University of Illinois.	Urbana	E. Davenport.[1]
Indiana	School of Agriculture of Purdue University.	Lafayette	J. H. Skinner.[1]
Iowa	Iowa State College of Agriculture and Mechanic Arts.	Ames	E. W. Stanton.[2]
Kansas	Kansas State Agricultural College	Manhattan	H. J. Waters.
Kentucky	The College of Agriculture of the State University.	Lexington	M. A. Scovell.[1]
	The Kentucky Normal and Industrial Institute for Colored Persons.	Frankfort	J. S. Hathaway.
Louisiana	Louisiana State University and Agricultural and Mechanical College.	Baton Rouge	T. D. Boyd.
	Southern University and Agricultural and Mechanical College.	New Orleans	H. A. Hill.
Maine	College of Agriculture of the University of Maine.	Orono	R. J. Aley.
Maryland	Maryland Agricultural College	College Park	R. W. Silvester.
	Princess Anne Academy for Colored Persons, Eastern Branch of the Maryland Agricultural College.	Princess Anne	T. H. Kiah.
Massachusetts	Massachusetts Agricultural College.	Amherst	K. L. Butterfield.
	Massachusetts Institute of Technology.[3]	Boston	R. C. Maclaurin.
Michigan	Michigan Agricultural College	East Lansing	J. L. Snyder.
Minnesota	College of Agriculture of the University of Minnesota.	University Farm, St. Paul.	A. F. Woods.[1]
Mississippi	Mississippi Agricultural and Mechanical College.	Agricultural College	J. C. Hardy.
	Alcorn Agricultural and Mechanical College.	Alcorn	J. A. Martin.
Missouri	College of Agriculture of the University of Missouri.	Columbia	F. B. Mumford.[1]
	School of Mines and Metallurgy of the University of Missouri.[3]	Rolla	L. E. Young.[4]
	Lincoln Institute	Jefferson City	B. F. Allen.
Montana	Montana Agricultural College	Bozeman	Jas. M. Hamilton.
Nebraska	College of Agriculture of the University of Nebraska.	Lincoln	E. A. Burnett.[1]
Nevada	College of Agriculture of the University of Nevada.	Reno	J. E. Stubbs.
New Hampshire	New Hampshire College of Agriculture and the Mechanic Arts.	Durham	W. D. Gibbs.
New Jersey	Rutgers Scientific School (The New Jersey State College for the Benefit of Agriculture and the Mechanic Arts).	New Brunswick	W. H. S. Demarest.
New Mexico	New Mexico College of Agriculture and Mechanic Arts.	State College	W. E. Garrison.

[1] Dean.
[2] Acting president.
[3] Does not maintain courses in agriculture.
[4] Director.

Agricultural colleges in the United States—Continued.

State or Territory.	Name of institution.	Location.	President.
New York	New York State College of Agriculture at Cornell University.	Ithaca	L. H. Bailey.[1]
North Carolina	The North Carolina College of Agriculture and Mechanic Arts.	West Raleigh	D. H. Hill.
	The Agricultural and Mechanical College for the Colored Race.	Greensboro	J. B. Dudley.
North Dakota	North Dakota Agricultural College.	Agricultural College	J. H. Worst.
Ohio	College of Agriculture of the Ohio State University.	Columbus	H. C. Price.[2]
Oklahoma	Oklahoma Agricultural and Mechanical College.	Stillwater	J. H. Connell.
	Agricultural and Normal University.	Langston	I. E. Page.
Oregon	Oregon State Agricultural College.	Corvallis	W. J. Kerr.
Pennsylvania	The Pennsylvania State College	State College	E. E. Sparks.
Porto Rico	University of Porto Rico	San Juan	E. G. Dexter.
Rhode Island	Rhode Island State College	Kingston	Howard Edwards.
South Carolina	The Clemson Agricultural College of South Carolina.	Clemson College	W. M. Riggs
	The Colored Normal, Industrial, Agricultural, and Mechanical College of South Carolina.	Orangeburg	R. S. Wilkinson.
South Dakota	South Dakota State College of Agriculture and Mechanic Arts.	Brookings	Robert L. Slagle.
Tennessee	College of Agriculture of the University of Tennessee.	Knoxville	Brown Ayres.
Texas	Agricultural and Mechanical College of Texas.	College Station	R. T. Milner.
	Prairie View State Normal and Industrial College.	Prairie View	E. L. Blackshear.
Utah	The Agricultural College of Utah	Logan	J. A. Widtsoe.
Vermont	University of Vermont and State Agricultural College.	Burlington	J. L. Hills.[2]
Virginia	The Virginia Agricultural and Mechanical College and Polytechnic Institute.	Blacksburg	P. B. Barringer.
	The Hampton Normal and Agricultural Institute.	Hampton	H. B. Frissell.
Washington	State College of Washington	Pullman	E. A. Bryan.
West Virginia	College of Agriculture of West Virginia University.	Morgantown	E. D. Sanderson.[2]
	The West Virginia Colored Institute.	Institute	Byrd Prillerman.
Wisconsin	College of Agriculture of the University of Wisconsin.	Madison	H. L. Russell.[2]
Wyoming	College of Agriculture and Mechanic Arts of the University of Wyoming.	Laramie	C. O. Merica.

[1] Director. [2] Dean.

AGRICULTURAL EXPERIMENT STATIONS OF THE UNITED STATES, THEIR LOCATIONS AND DIRECTORS.

Alabama (College), Auburn: J. F. Duggar.
Alabama (Canebrake), Uniontown: L. H. Moore.
Alabama (Tuskegee), Tuskegee Institute: G. W. Carver.
Alaska, Sitka (Rampart, Kodiak, and Fairbanks): C. C. Georgeson.[1]
Arizona, Tucson: R. H. Forbes.
Arkansas, Fayetteville: C. F. Adams.
California, Berkeley: E. J. Wickson.
Colorado, Fort Collins: C. P. Gillette.
Connecticut (State), New Haven: E. H. Jenkins.
Connecticut (Storrs), Storrs: L. A. Clinton.
Delaware, Newark: Harry Hayward.
Florida, Gainesville: P. H. Rolfs.
Georgia, Experiment: M. V. Calvin.
Guam:[2] J. B. Thompson.[1]
Hawaii (Federal), Honolulu: E. V. Wilcox.[1]
Hawaii (Sugar Planters'), Honolulu. C. F. Eckart.
Idaho, Moscow: W. L. Carlyle.
Illinois, Urbana: E. Davenport.
Indiana, Lafayette: Arthur Goss.
Iowa, Ames: C. F. Curtiss.
Kansas, Manhattan: E. H. Webster.
Kentucky, Lexington: M. A. Scovell.
Louisiana (Sugar), New Orleans: W. R. Dodson.
Louisiana (State), Baton Rouge: W. R. Dodson.
Louisiana (North), Calhoun: W. R. Dodson.
Louisiana (Rice), Crowley: W. R. Dodson.
Maine, Orono: C. D. Woods.
Maryland, College Park: H. J. Patterson.
Massachusetts, Amherst: W. P. Brooks.
Michigan, East Lansing: R. S. Shaw.
Minnesota, University Farm, St. Paul: A. F. Woods.
Mississippi, Agricultural College: E. R. Lloyd.
Missouri (College), Columbia: F. B. Mumford.
Missouri (Fruit), Mountain Grove: Paul Evans.
Montana, Bozeman: F. B. Linfield.
Nebraska, Lincoln: E. A. Burnett.
Nevada, Reno: G. H. True.

[1] Special agent in charge. [2] Address: Island of Guam, via San Francisco.

New Hampshire, Durham: J. C. Kendall.
New Jersey (State), New Brunkswick: J. G. Lipman.
New Jersey (College), New Brunswick: J. G. Lipman.
New Mexico, State College: Luther Foster.
New York (State), Geneva: W. H. Jordan.
New York (Cornell), Ithaca: L. H. Bailey.
North Carolina (College), West Raleigh: C. B. Williams.
North Carolina (State), Raleigh: B. W. Kilgore.
North Dakota, Agricultural College: J. H. Worst.
Ohio, Wooster: C. E. Thorne.
Oklahoma, Stillwater: J. A. Wilson.
Oregon, Corvallis: J. Withycombe.
Pennsylvania, State College: T. F. Hunt.
Pennsylvania (Institute of Animal Nutrition), State College: H. P. Armsby.
Porto Rico (Federal), Mayaguez: D. W. May.[1]
Porto Rico (Sugar), Rio Piedras: J. T. Crawley.
Rhode Island, Kingston: H. J. Wheeler.
South Carolina, Clemson College: J. N. Harper.
South Dakota, Brookings: J. W. Wilson.
Tennessee, Knoxville: H. A. Morgan.
Texas, College Station: B. Youngblood.
Utah, Logan: E. D. Ball.
Vermont, Burlington: J. L. Hills.
Virginia (College), Blacksburg: S. W. Fletcher.
Virginia (Truck), Norfolk: T. C. Johnson.
Washington, Pullman: R. W. Thatcher.
West Virginia, Morgantown: E. D. Sanderson.
Wisconsin, Madison: H. L. Russell.
Wyoming, Laramie: H. G. Knight.

STATE OFFICIALS IN CHARGE OF AGRICULTURE.

Alabama: Commissioner of Agriculture, Montgomery.
Alaska: Special Agent in charge of Experiment Stations, Sitka.
Arizona: Director of Experiment Station, Tucson.
Arkansas: Commissioner of Agriculture, Little Rock.
California: Secretary of State Board of Agriculture, Sacramento.
Colorado: Secretary of State Board of Agriculture, Fort Collins.
Connecticut: Secretary of State Board of Agriculture, Hartford.
Delaware: Secretary of State Board of Agriculture, Dover.
Florida: Commissioner of Agriculture, Tallahassee.
Georgia: Commissioner of Agriculture, Atlanta.
Hawaii: Secretary of Territorial Board of Agriculture, Honolulu.
Idaho: Commissioner of Immigration, Labor, and Statistics, Boise.
Illinois: Secretary of State Board of Agriculture, Springfield.
Indiana: Secretary of State Board of Agriculture, Indianapolis.
Iowa: Secretary of State Board of Agriculture, Des Moines.
Kansas: Secretary of State Board of Agriculture, Topeka.
Kentucky: Commissioner of Agriculture, Frankfort.
Louisiana: Commissioner of Agriculture, Baton Rouge.
Maine: Commissioner of Agriculture, Augusta.
Maryland: Director of Experiment Station, College Park.
Massachusetts: Secretary of State Board of Agriculture, Boston.
Michigan: Secretary of State Board of Agriculture, East Lansing.
Minnesota: Secretary of State Agricultural Society, St. Paul.
Mississippi: Commissioner of Agriculture, Jackson.
Missouri: Secretary of State Board of Agriculture, Columbia.
Montana: Commissioner of Agriculture, Helena.
Nebraska: Secretary of State Board of Agriculture, Lincoln.
Nevada: Secretary of State Board of Agriculture, Carson City.
New Hampshire: Secretary of State Board of Agriculture, Concord.
New Jersey: Secretary of State Board of Agriculture, Trenton.
New Mexico: Director of Experiment Station, Agricultural College.
New York: Commissioner of Agriculture, Albany.
North Carolina: Commissioner of Agriculture, Raleigh.
North Dakota: Commissioner of Agriculture, Bismarck.
Ohio: Secretary of State Board of Agriculture, Columbus.
Oklahoma: President of State Board of Agriculture, Oklahoma
Oregon: Secretary of State Board of Agriculture, Salem.
Pennsylvania: Secretary of Agriculture, Harrisburg.
Philippine Islands: Director of Agriculture, Manila.
Porto Rico: Director of Experiment Station, Mayaguez.
Rhode Island: Secretary of State Board of Agriculture, Providence.
South Carolina: Commissioner of Agriculture, Columbia.
South Dakota: Secretary of State Board of Agriculture, Huron.
Tennessee: Commissioner of Agriculture, Nashville.
Texas: Commissioner of Agriculture, Austin.
Utah: Director of Experiment Station, Logan.
Vermont: Commissioner of Agriculture, Plainfield.
Virginia: Commissioner of Agriculture, Richmond.
Washington: Director of Experiment Station, Pullman.
West Virginia: Secretary of State Board of Agriculture, Charleston.
Wisconsin: Secretary of State Board of Agriculture, Madison
Wyoming: Director of Experiment Station, Laramie.

[1] Special agent in charge.

STATISTICS OF THE PRINCIPAL CROPS.

Figures furnished by the Bureau of Statistics, Department of Agriculture, except where otherwise stated.
[All prices are gold.]

CORN.

Corn area of countries named, 1906–1910.

Country.	1906	1907	1908	1909	1910
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	96,738,000	99,931,000	101,788,000	98,383,000	104,035,000
Canada:					
Ontario	289,500	338,600	332,200	320,000	299,000
Quebec	(1)	35,800	33,600	32,200	29,100
Mexico	(1)	(1)	(1)	(1)	13,375,400
SOUTH AMERICA.					
Argentina	6,714,400	7,045,600	6,719,300	7,348,500	7,425,400
Chile	52,200	(1)	62,600	62,000	67,300
Uruguay	411,100	524,200	(1)	502,300	(1)
EUROPE.					
Austria-Hungary:					
Austria	847,500	860,800	845,100	831,200	770,400
Hungary proper	5,714,300	6,031,600	5,831,100	6,209,600	5,997,700
Croatia-Slavonia	1,004,800	988,100	1,033,300	1,003,200	1,004,200
Bosnia-Herzegovina	711,300	777,900	702,900	529,900	494,200
Total Austria-Hungary	8,277,900	8,658,400	8,412,400	8,573,900	8,266,500
Bulgaria	1,254,400	1,231,300	1,410,400	1,501,000	1,511,100
France	1,154,900	1,236,500	1,226,200	1,222,600	1,192,100
Italy	4,491,000	4,483,500	4,444,700	4,005,000	3,757,200
Portugal	(1)	(1)	(1)	(1)	(1)
Roumania	5,144,500	4,765,600	4,992,300	5,247,100	4,908,000
Russia:					
Russia proper	2,573,300	2,899,300	2,970,900	3,050,800	....
Poland	(1)	(1)	(1)	(1)	....
Northern Caucasia	630,000	571,300	659,400	733,600	....
Total Russia (European)	[2] 3,203,300	[2] 3,470,600	[2] 3,630,300	[2] 3,784,400	....
Servia	(1)	1,358,400	1,392,600	1,383,800	1,445,500
Spain	1,103,000	1,109,500	1,133,300	1,149,100	1,145,100
ASIA.					
British India (including native States)	5,790,500	6,171,700	6,296,400	6,784,200	6,857,900
Japan	(1)	(1)	128,700	120,300	(1)
AFRICA.					
Algeria	37,500	39,000	37,600	53,500	34,900
Egypt	1,837,400	1,867,700	1,868,100	1,910,600	(1)
Union of South Africa	(1)	(1)	(1)	(1)	(1)
AUSTRALASIA.					
Australia:					
Queensland	113,700	139,800	127,100	127,700	132,300
New South Wales	189,400	174,100	161,000	180,800	212,800
Victoria	11,800	11,600	10,900	14,000	19,100
Western Australia	100	100	200	200	200
South Australia	....	....	....	....	200
New Zealand	10,500	8,900	8,900	11,500	12,500
Total Australasia	325,500	334,500	308,100	334,200	377,100

[1] No official statistics of area; estimates of production on p. 520

[2] Exclusive of Poland.

CORN—Continued.

Corn crop of countries named, 1906-1910.

Country.	1906	1907	1908	1909	1910
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	2,927,416,000	2,592,320,000	2,668,651,000	2,552,190,000	2,886,260,000
Canada:					
Ontario	23,989,000	21,899,000	21,742,000	18,211,000	17,853,000
Quebec	....	1,377,000	1,126,000	1,047,000	860,000
Mexico	110,065,000	140,000,000	150,000,000	170,000,000	190,766,000
Total	3,061,470,000	2,755,596,000	2,841,519,000	2,741,448,000	3,095,739,000
SOUTH AMERICA.					
Argentina	194,910,000	71,768,000	136,055,000	177,155,000	175,187,000
Chile	846,000	1,500,000	1,218,000	1,178,000	1,878,000
Uruguay	3,226,000	5,359,000	6,000,000	6,671,000	6,500,000
Total	198,982,000	78,627,000	143,273,000	185,004,000	183,565,000
EUROPE.					
Austria-Hungary:					
Austria	18,177,000	16,599,000	15,170,000	16,102,000	17,388,000
Hungary proper	162,925,000	155,619,000	146,124,000	161,858,000	187,733,000
Croatia-Slavonia	20,470,000	17,934,000	20,536,000	21,752,000	25,589,000
Bosnia-Herzegovina	8,900,000	6,468,000	8,821,000	10,972,000	10,051,000
Total Austria-Hungary	210,472,000	196,620,000	190,651,000	210,684,000	240,761,000
Bulgaria	27,780,000	14,080,000	20,717,000	20,472,000	28,360,000
France	14,581,000	24,027,000	26,247,000	26,075,000	23,399,000
Italy	93,007,000	88,513,000	95,953,000	99,289,000	101,722,000
Portugal	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000
Roumania	130,546,000	57,576,000	78,892,000	70,138,000	103,665,000
Russia:					
Russia proper	59,320,000	41,903,000	49,663,000	29,223,000	....
Poland	....	1,000	....	....	....
Northern Caucasia	11,181,000	8,860,000	11,449,000	10,375,000	....
Total Russia (European)	70,501,000	50,764,000	61,112,000	39,598,000	77,181,000
Servia	27,786,000	17,691,000	21,010,000	27,558,000	27,500,000
Spain	18,714,000	25,372,000	20,115,000	26,433,000	27,366,000
Total	608,387,000	489,643,000	529,697,000	535,247,000	644,954,000
AFRICA.					
Algeria	544,000	402,000	426,000	807,000	552,000
Egypt	65,000,000	65,000,000	65,000,000	65,000,000	70,294,000
Union of South Africa	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
Total	85,544,000	85,402,000	85,426,000	85,807,000	90,846,000
AUSTRALASIA.					
Australia:					
Queensland	2,233,000	3,820,000	3,191,000	2,855,000	2,588,000
New South Wales	5,714,000	5,945,000	4,671,000	5,380,000	7,322,000
Victoria	661,000	727,000	525,000	671,000	1,195,000
Western Australia	1,000	1,000	1,000	2,000	1,000
South Australia	....	....	....	....	7,000
Total	8,609,000	10,493,000	8,388,000	8,908,000	11,113,000
New Zealand	653,000	419,000	519,000	736,000	750,000
Total Australasia	9,262,000	10,912,000	8,907,000	9,644,000	11,863,000
Grand total	3,963,645,000	3,420,180,000	3,608,822,000	3,557,150,000	4,026,967,000

CORN—Continued.

Acreage, production, value, prices, and exports of corn in the United States, 1849–1911.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, including corn meal, fiscal year beginning July 1.	Per cent of crop exported.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*P. ct.*
1849 [1]			*592,071,000*							*7,632,860*	*1.3*
1859 [1]			*838,793,000*							*4,248,991*	*.5*
1866	34,307,000	25.3	867,946,000	47.4	411,451,000	53	62	64	79	16,026,947	1.8
1867	32,520,000	23.6	768,320,000	57.0	437,770,000	61	65	61	71	12,493,522	1.6
1868	34,887,000	26.0	906,527,000	46.8	424,057,000	38	58	44	51	8,286,665	.9
1869	37,103,000	23.6	874,320,000	59.8	522,551,000	56	67	73	85	2,140,487	.2
1869 [1]			*760,945,000*								
1870	38,647,000	28.3	1,094,255,000	49.4	540,520,000	41	59	46	52	10,673,553	1.0
1871	34,091,000	29.1	991,898,000	43.4	430,356,000	36	39	38	43	35,727,010	3.6
1872	35,527,000	30.8	1,092,719,000	35.3	385,736,000	27	28	34	39	40,154,374	3.7
1873	39,197,000	23.8	932,274,000	44.2	411,961,000	40	49	49	59	35,985,834	3.9
1874	41,037,000	20.7	850,148,000	58.4	496,271,000	64	76	53	67	30,025,036	3.5
1875	44,841,000	29.5	1,321,069,000	36.7	484,675,000	40	47	41	45	50,910,532	3.9
1876	49,033,000	26.2	1,283,828,000	34.0	436,109,000	40	43	43	56	72,652,611	5.7
1877	50,369,000	26.7	1,342,558,000	34.8	467,635,000	41	49	35	41	87,192,110	6.5
1878	51,585,000	26.9	1,388,219,000	31.7	440,281,000	30	32	33	36	87,884,892	6.3
1879	53,085,000	29.2	1,547,902,000	37.5	580,486,000	39	43¼	32⅜	36⅛	99,572,329	6.4
1879 [1]	*62,369,000*	*28.1*	*1,754,592,000*								
1880	62,318,000	27.6	1,717,435,000	39.6	679,714,000	35⅝	42	41½	45	93,648,147	5.5
1881	64,262,000	18.6	1,194,916,000	63.6	759,482,000	58½	63½	69	76⅞	44,340,683	3.7
1882	65,660,000	24.6	1,617,025,000	48.5	783,867,000	49¼	61	53¼	56¾	41,655,653	2.6
1883	68,302,000	22.7	1,551,067,000	42.4	658,051,000	54¼	63⅛	52½	57	46,258,606	3.0
1884	69,684,000	25.8	1,795,528,000	35.7	640,736,000	34½	40¼	44¾	49	52,876,456	2.9
1885	73,130,000	26.5	1,936,176,000	32.8	635,675,000	36	42¾	34¼	36¾	64,829,617	3.3
1886	75,694,000	22.0	1,665,441,000	36.6	610,311,000	35¾	38	36⅞	39⅜	41,368,584	2.5
1887	72,393,000	20.1	1,456,161,000	44.4	646,107,000	47	51⅛	54	60	25,360,869	1.7
1888	75,673,000	26.3	1,987,790,000	34.1	677,562,000	33½	35⅞	33⅛	35⅜	70,841,673	3.6
1889	78,320,000	27.0	2,112,892,000	28.3	597,919,000	29¼	35	32¾	35	103,418,709	4.9
1889 [1]	*72,088,000*	*29.4*	*2,122,328,000*								
1890	71,971,000	20.7	1,489,970,000	50.6	754,433,000	47¾	53	55	69½	32,041,529	2.2
1891	76,205,000	27.0	2,060,154,000	40.6	836,439,000	39⅜	59	40¾	[2] 100	76,602,285	3.7
1892	70,627,000	23.1	1,628,464,000	39.4	642,147,000	40	42⅞	39½	44½	47,121,894	2.9
1893	72,036,000	22.5	1,619,496,000	36.5	591,626,000	34¼	36½	36¾	38½	66,489,529	4.1
1894	62,582,000	19.4	1,212,770,000	45.7	554,719,000	44¾	47½	47¾	55½	28,585,405	2.4
1895	82,076,000	26.2	2,151,139,000	25.3	544,986,000	25	26¾	27½	29½	101,100,375	4.7
1896	81,027,000	28.2	2,283,875,000	21.5	491,007,000	22½	23¾	23	25½	178,817,417	7.8
1897	80,095,000	23.8	1,902,968,000	26.3	501,073,000	25	27½	32⅜	37	212,055,543	11.1
1898	77,722,000	24.8	1,924,185,000	28.7	552,023,000	33⅛	38	32½	34⅜	177,255,046	9.2
1899	82,109,000	25.3	2,078,144,000	30.3	629,210,000	30	31½	36	40½	213,123,412	10.3
1899 [1]	*94,914,000*	*28.1*	*2,666,324,000*								
1900	83,321,000	25.3	2,105,103,000	35.7	751,220,000	35¼	40½	42⅝	58½	181,405,473	8.6
1901	91,350,000	16.7	1,522,520,000	60.5	921,556,000	62½	67½	59⅛	64¾	28,028,688	1.8
1902	94,044,000	26.8	2,523,648,000	40.3	1,017,017,000	43¾	57¼	44	46	76,639,261	3.0
1903	88,092,000	25.5	2,244,177,000	42.5	952,869,000	41	43¾	47¼	50	58,222,061	2.6
1904	92,232,000	26.8	2,467,481,000	44.1	1,087,461,000	43½	49	48	64½	90,293,483	3.7
1905	94,011,000	28.8	2,707,994,000	41.2	1,116,697,000	42	50¼	47½	50	119,893,833	4.4
1906	96,738,000	30.3	2,927,416,000	39.9	1,166,626,000	40	46	49½	56	86,368,228	3.0
1907	99,931,000	25.9	2,592,320,000	51.6	1,336,901,000	57½	61½	67¾	82	55,063,860	2.1
1908	101,788,000	26.2	2,668,651,000	60.6	1,616,145,000	56¾	62¼	72¼	76	37,665,040	1.4
1909	108,771,000	25.5	2,772,376,000	59.6	1,652,822,000	62½	66	56	63	38,128,498	1.4
1909 [1]	*98,383,000*	*25.9*	*2,552,190,000*								
1910 [3]	104,035,000	27.7	2,886,260,000	48.0	1,384,817,000	45½	50	52¼	55¼	65,614,522	2.3
1911 [3]	105,825,000	23.9	2,531,488,000	61.8	1,565,258,000	68	70				

[1] Census figures. [2] Coincident with "corner." [3] Figures adjusted to census basis.

CORN—Continued.

Acreage, production, farm value, and distribution of corn in the United States, by States, 1911–1909.

State and Division.	Acreage.			Production.		
	1911	1910	1909 (Census.)	1911	1910	1909 (Census.)
	Acres.	*Acres.*	*Acres.*	*Bushels.*	*Bushels.*	*Bushels.*
Maine	18,000	17,000	15,000	792,000	782,000	649,000
New Hampshire	23,000	22,000	20,000	1,035,000	1,012,000	916,000
Vermont	46,000	44,000	43,000	1,886,000	1,892,000	1,715,000
Massachusetts	47,000	45,000	42,000	2,068,000	2,048,000	2,029,000
Rhode Island	11,000	10,000	10,000	495,000	400,000	398,000
Connecticut	59,000	57,000	53,000	2,862,000	3,032,000	2,531,000
New York	530,000	525,000	512,000	20,405,000	20,108,000	18,116,000
New Jersey	270,000	267,000	265,000	9,936,000	9,612,000	10,001,000
Pennsylvania	1,435,000	1,430,000	1,381,000	63,858,000	58,630,000	41,494,000
N. Atlantic	2,439,000	2,417,000	2,341,000	103,337,000	97,516,000	77,849,000
Delaware	195,000	193,000	189,000	6,630,000	6,137,000	4,840,000
Maryland	670,000	660,000	647,000	24,455,000	22,110,000	17,924,000
Virginia	1,980,000	1,960,000	1,860,000	47,520,000	49,980,000	38,295,000
West Virginia	707,000	700,000	676,000	18,170,000	18,200,000	17,119,000
North Carolina	2,700,000	2,650,000	2,459,000	49,680,000	49,290,000	34,063,000
South Carolina	1,790,000	1,707,000	1,566,000	32,578,000	31,580,000	20,872,000
Georgia	3,692,000	3,585,000	3,383,000	59,072,000	51,982,000	39,375,000
Florida	636,000	630,000	606,000	9,286,000	8,190,000	7,024,000
S. Atlantic	12,370,000	12,085,000	11,386,000	247,391,000	237,469,000	179,512,000
Ohio	3,900,000	3,960,000	3,916,000	150,540,000	144,540,000	157,513,000
Indiana	4,850,000	4,800,000	4,901,000	174,600,000	188,640,000	195,496,000
Illinois	10,150,000	10,250,000	10,046,000	334,950,000	400,775,000	390,219,000
Michigan	1,690,000	1,670,000	1,590,000	55,770,000	54,108,000	52,907,000
Wisconsin	1,600,000	1,520,000	1,458,000	58,080,000	49,400,000	49,163,000
N. C. E. Miss. R.	22,190,000	22,200,000	21,911,000	773,940,000	837,463,000	845,298,000
Minnesota	2,200,000	2,040,000	2,004,000	74,140,000	66,708,000	67,897,000
Iowa	9,850,000	9,470,000	9,229,000	305,350,000	343,761,000	341,750,000
Missouri	7,400,000	7,500,000	7,114,000	192,400,000	247,500,000	191,427,000
North Dakota	290,000	210,000	185,000	7,250,000	2,940,000	4,941,000
South Dakota	2,310,000	2,100,000	2,038,000	50,820,000	52,500,000	55,559,000
Nebraska	7,425,000	7,425,000	7,266,000	155,925,000	191,565,000	180,133,000
Kansas	8,700,000	8,950,000	8,109,000	126,150,000	170,050,000	154,652,000
N. C. W. Miss. R.	38,175,000	37,695,000	35,945,000	912,035,000	1,075,024,000	996,359,000
Kentucky	3,600,000	3,500,000	3,436,000	93,600,000	101,500,000	83,348,000
Tennessee	3,400,000	3,400,000	3,146,000	91,120,000	88,060,000	67,682,000
Alabama	3,000,000	2,850,000	2,573,000	54,000,000	51,300,000	30,696,000
Mississippi	2,850,000	2,590,000	2,173,000	54,150,000	53,095,000	28,429,000
Louisiana	1,800,000	1,782,000	1,591,000	33,300,000	42,055,000	26,010,000
Texas	7,300,000	6,800,000	5,130,000	69,350,000	140,080,000	75,499,000
Oklahoma	5,675,000	5,735,000	5,914,000	36,888,000	91,760,000	94,283,000
Arkansas	2,390,000	2,390,000	2,277,000	49,712,000	57,360,000	37,610,000
S. Central	30,015,000	29,047,000	26,240,000	482,120,000	625,210,000	443,557,000
Montana	20,000	16,000	10,000	530,000	368,000	274,000
Wyoming	13,000	11,000	9,000	195,000	110,000	176,000
Colorado	373,000	346,000	327,000	5,222,000	6,885,000	4,903,000
New Mexico	94,000	89,000	86,000	2,322,000	2,047,000	1,165,000
Arizona	15,000	15,000	16,000	495,000	488,000	299,000
Utah	8,000	7,000	7,000	280,000	212,000	170,000
Nevada	1,000	1,000	1,000	30,000	30,000	21,000
Idaho	11,000	10,000	9,000	330,000	320,000	318,000
Washington	30,000	28,000	26,000	855,000	784,000	563,000
Oregon	20,000	18,000	17,000	570,000	459,000	452,000
California	51,000	50,000	52,000	1,836,000	1,875,000	1,274,000
Far Western	636,000	591,000	560,000	12,665,000	13,578,000	9,915,000
United States	105,825,000	104,035,000	98,383,000	2,531,488,000	2,886,260,000	2,552,190,000

CORN—Continued.

Acreage, production, farm value, and distribution of corn in the United States, by States, 1911-1909—Continued.

State and Division.	Value basis Dec. 1 price.			Farm reserves of old crop Nov. 1.		Shipped.[1]
	1911	1910	1909	1911	1910	
	Dollars.	*Dollars.*	*Dollars.*	*Bushels.*	*Bushels.*	*Per cent.*
Maine	713,000	555,000	519,000	16,000	6,000	1
New Hampshire	849,000	698,000	696,000	12,000	7,000	0
Vermont	1,509,000	1,249,000	1,252,000	47,000	51,000	0
Massachusetts	1,716,000	1,434,000	1,644,000	51,000	51,000	0
Rhode Island	470,000	332,000	386,000	19,000	21,000	1
Connecticut	2,375,000	2,062,000	1,898,000	61,000	58,000	1
New York	15,712,000	12,668,000	13,406,000	402,000	290,000	2
New Jersey	7,055,000	5,767,000	7,101,000	481,000	550,000	15
Pennsylvania	43,423,000	34,592,000	29,046,000	2,521,000	1,411,000	7
N. Atlantic	73,822,000	59,357,000	55,948,000	3,610,000	2,445,000	6.2
Delaware	4,044,000	3,191,000	2,807,000	209,000	136,000	34
Maryland	15,407,000	12,824,000	11,651,000	553,000	556,000	24
Virginia	34,690,000	32,487,000	28,338,000	1,999,000	1,149,000	9
West Virginia	13,991,000	12,376,000	12,668,000	655,000	548,000	3
North Carolina	40,738,000	37,460,000	28,954,000	1,479,000	749,000	5
South Carolina	29,646,000	25,896,000	18,785,000	1,168,000	647,000	4
Georgia	49,030,000	40,546,000	33,862,000	1,248,000	906,000	3
Florida	7,429,000	6,962,000	5,830,000	90,000	56,000	2
S. Atlantic	194,975,000	171,742,000	142,895,000	7,401,000	4,747,000	7.6
Ohio	87,313,000	66,488,000	88,207,000	5,059,000	8,033,000	25
Indiana	94,284,000	75,456,000	97,748,000	8,300,000	10,948,000	31
Illinois	184,222,000	152,294,000	202,914,000	19,638,000	21,852,000	44
Michigan	36,250,000	28,677,000	32,273,000	1,894,000	1,852,000	4
Wisconsin	34,848,000	25,688,000	29,498,000	1,087,000	1,377,000	3
N. C. E. Miss. R	436,917,000	348,603,000	450,640,000	35,978,000	44,062,000	31.4
Minnesota	39,294,000	30,019,000	33,270,000	2,535,000	3,055,000	14
Iowa	161,836,000	123,754,000	167,458,000	18,563,000	20,505,000	30
Missouri	115,440,000	108,900,000	112,942,000	17,572,000	6,891,000	12
North Dakota	4,350,000	1,705,000	2,718,000	41,000	64,000	1
South Dakota	26,935,000	21,000,000	27,779,000	840,000	2,500,000	31
Nebraska	85,759,000	68,963,000	90,066,000	9,578,000	14,050,000	30
Kansas	79,474,000	76,522,000	83,512,000	9,353,000	6,495,000	18
N. C. W. M. R	513,088,000	430,863,000	517,745,000	58,482,000	53,560,000	23.1
Kentucky	58,968,000	53,795,000	51,676,000	5,075,000	4,167,000	7
Tennessee	55,583,000	49,314,000	47,378,000	3,522,000	1,963,000	16
Alabama	42,120,000	36,423,000	26,091,000	1,026,000	338,000	3
Mississippi	38,988,000	33,450,000	23,027,000	903,000	284,000	3
Louisiana	23,310,000	23,130,000	17,947,000	841,000	260,000	10
Texas	55,480,000	88,250,000	57,379,000	2,101,000	1,057,000	3
Oklahoma	25,822,000	46,798,000	51,856,000	2,569,000	1,886,000	16
Arkansas	35,793,000	33,269,000	27,079,000	2,065,000	639,000	4
S. Central	336,064,000	364,429,000	302,433,000	18,102,000	10,594,000	7.8
Montana	424,000	350,000	236,000	2,000	4,000	3
Wyoming	148,000	73,000	138,000	1,000	2,000	0
Colorado	4,073,000	4,131,000	3,432,000	131,000	221,000	15
New Mexico	1,950,000	1,842,000	1,048,000	61,000	27,000	9
Arizona	480,000	537,000	299,000	10,000	4,000	9
Utah	227,000	178,000	148,000	0	1,000	5
Nevada	27,000	30,000	18,000	0	0	....
Idaho	280,000	227,000	239,000	2,000	2,000	5
Washington	675,000	588,000	484,000	7,000	7,000	4
Oregon	456,000	367,000	361,000	9,000	11,000	2
California	1,652,000	1,500,000	1,159,000	28,000	9,000	20
Far Western	10,392,000	9,823,000	7,562,000	251,000	288,000	11.8
United States	1,565,258,000	1,384,817,000	1,477,223,000	123,824,000	115,696,000	20.5

[1] Percentage of 1911 crop which was shipped out of county of growth.

CORN—Continued.

Average yield per acre, and farm price per bushel of corn in the United States, 1870–1911.

State and Division.	Yield per acre. Ten-year averages. 1870–1879.	1880–1889.	1890–1899.	1900–1909.	1910.	1911.	Farm price per bushel. Ten-year averages for Dec. 1. 1870–1879.	1880–1889.	1890–1899.	1900–1909.	Dec. 1, 1910.	Quarterly, 1911. Mar. 1.	June 1.	Sept. 1.	Dec. 1.
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
Maine	31.0	32.2	37.1	35.4	46.0	44.0	83	75	60	72	71	62	67	76	90
New Hampshire	37.8	32.7	37.2	33.1	46.0	45.0	82	75	58	70	69	66	70	78	82
Vermont	37.3	32.6	38.2	34.5	43.0	41.0	80	71	56	68	66	60	67	77	80
Massachusetts	34.7	31.6	37.6	36.1	45.5	44.0	79	74	58	71	70	63	78	75	83
Rhode Island	29.6	30.1	31.7	33.0	40.0	45.0	83	77	63	79	83	85	84	81	95
Connecticut	29.8	30.1	34.9	36.8	53.2	48.5	84	71	58	70	68	68	65	75	83
New York	33.0	29.8	31.4	31.0	38.3	38.5	66	62	52	66	63	61	66	71	77
New Jersey	36.3	30.5	33.0	34.1	36.0	36.8	59	59	49	59	60	58	62	72	71
Pennsylvania	35.7	31.0	32.6	34.4	41.0	44.5	57	56	46	59	59	58	63	73	68
North Atlantic	34.8	30.7	32.7	33.6	40.3	42.4	61.8	59.6	49.1	61.7	60.9	59.3	64.2	72.8	71.4
Delaware	23.4	19.3	22.5	29.1	31.8	34.0	51	47	39	50	52	49	60	75	61
Maryland	25.2	24.2	27.0	32.9	33.5	36.5	54	49	41	52	58	56	66	77	63
Virginia	20.1	16.8	19.1	22.7	25.5	24.0	51	51	43	59	65	66	71	82	73
West Virginia	28.3	23.4	24.4	27.5	26.0	25.7	49	51	48	63	68	69	76	84	77
North Carolina	14.7	12.2	13.0	14.8	18.6	18.4	57	59	47	68	76	77	80	93	82
South Carolina	9.4	9.4	9.9	11.6	18.5	18.2	80	68	56	76	82	81	86	94	91
Georgia	11.2	10.4	11.1	11.5	14.5	16.0	73	66	54	73	78	76	83	89	83
Florida	10.2	9.6	9.7	10.2	13.0	14.6	91	76	61	74	85	83	87	86	80
South Atlantic	15.0	13.8	14.5	16.1	19.6	20.0	61.0	57.5	48.1	65.7	72.3	72.4	78.1	87.4	78.8
Ohio	36.1	30.8	31.4	35.6	36.5	38.6	39	43	35	48	46	45	55	66	58
Indiana	32.6	28.9	31.3	34.7	39.3	36.0	34	39	31	43	40	39	48	60	54
Illinois	30.3	26.8	31.7	34.5	39.1	33.0	30	36	30	43	38	40	47	60	55
Michigan	33.1	28.9	29.0	32.7	32.4	33.0	46	46	40	51	53	48	55	63	65
Wisconsin	33.1	27.3	30.6	33.2	32.5	36.3	40	41	34	48	52	50	53	63	60
N. C. E. Miss. R.	32.1	28.1	31.3	34.3	37.7	34.9	34.0	39.0	32.0	44.5	41.6	41.8	49.5	61.4	56.5
Minnesota	32.5	29.9	28.1	29.4	32.7	33.7	37	37	31	41	45	42	48	57	53
Iowa	34.5	30.6	30.9	32.3	36.3	31.0	25	30	27	39	36	37	44	56	53
Missouri	30.2	27.4	27.4	28.6	33.0	26.0	32	35	31	45	44	44	48	61	60
North Dakota	....	25.3	20.8	23.4	14.0	25.0	.....	36	36	46	58	54	57	64	60
South Dakota			20.1	27.4	25.0	22.0	.....		30	39	40	38	45	55	53
Nebraska	34.5	32.7	24.5	27.4	25.8	21.0	26	25	27	38	36	35	43	55	55
Kansas	34.3	28.6	21.3	22.4	19.0	14.5	32	30	30	42	45	41	48	59	63
N. C. W. Miss. R.	33.1	29.4	26.2	27.9	28.5	23.9	27.8	30.4	28.3	40.4	40.1	39.3	45.7	57.5	56.3
Kentucky	29.7	23.8	25.7	26.7	29.0	26.0	38	44	37	51	53	56	63	73	63
Tennessee	24.2	20.5	22.0	23.0	25.9	26.8	43	45	38	55	56	57	59	68	61
Alabama	13.9	12.6	12.8	13.5	18.0	18.0	70	62	51	69	71	71	77	81	78
Mississippi	15.4	14.3	15.0	15.2	20.5	19.0	72	61	49	67	63	67	74	78	72
Louisiana	17.2	16.0	16.3	17.5	23.6	18.5	78	62	51	64	55	61	64	69	70
Texas	21.7	18.1	19.0	19.0	20.6	9.5	68	56	46	59	63	65	67	81	80
Oklahoma	....	....	....	24.2	16.0	6.5	....	....	....	44	51	51	58	68	70
Arkansas	24.4	19.8	18.2	18.7	24.0	20.8	59	53	43	58	58	62	66	72	72
South Central	21.2	18.5	19.0	20.1	21.5	16.1	53.9	51.4	42.8	55.5	58.3	61.0	65.4	74.4	69.7
Montana	....	26.4	25.0	23.2	23.0	26.5	.....	79	67	73	95	....	95	....	80
Wyoming		....	21.2	28.0	10.0	15.0	.....	.....	59	66	66	60	65	....	76
Colorado	[1]29.2	26.1	18.9	21.2	19.9	14.0	[1]90	72	47	59	60	53	62	70	78
New Mexico	....	19.9	21.4	26.4	23.0	24.7	.....	76	65	76	90	85	97	113	84
Arizona	....	20.9	20.0	27.1	32.5	33.0	.....	80	76	94	110	95	110	100	97
Utah	....	21.0	21.2	26.9	30.3	35.0	.....	71	58	74	84	71	81	70	81
Nevada	30.9	24.4	....	....	30.0	30.5	135	74	....	....	100	....	....	....	90
Idaho	....	23.3	23.9	28.5	32.0	30.0	.....	80	65	65	71	60	102	86	85
Washington	....	24.8	18.0	23.8	28.0	28.5	.....	74	55	65	75	68	82	85	79
Oregon	29.3	23.8	24.0	25.8	25.5	28.5	90	72	58	66	80	90	94	85	80
California	34.8	28.0	30.5	31.4	37.5	36.0	96	70	58	76	80	79	86	87	90
Far Western	31.5	26.2	22.6	25.1	23.0	19.9	92.0	72.2	54.0	68.6	72.3	71.7	80.9	86.7	82.1
United States	27.1	24.1	24.1	25.8	27.7	23.9	40.5	40.6	34.5	47.6	48.0	48.9	55.1	65.9	61.8

[1] The Territories.

CORN—Continued.

Wholesale prices of corn per bushel, 1898–1911.

Date.	New York.		Baltimore.		Cincinnati.		Chicago.		Detroit.		St. Louis.		San Francisco.	
	No. 2 mixed.		Mixed.[1]		No. 2.		No. 2.		No. 3.[2]		No. 2.		No. 1 white (per 100 lbs.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.		
1898	33	44¼	29	43½	29	40	26	38	28½	39½	25¼	36¼	$0.85	$1.17½
1899	36½	45⅝	34¾	43	31½	38	30	38⅛	32	38	29½	36¼	1.05	1.17½
1900	39⅞	52⅛	36⅝	48¾	32¾	47	30½	49½	32½	45	30½	43	1.00	1.30
1901	45½	72⅞	41½	68	38	71½	36	67½	37	70½	35	70	1.10	1.75
1902	57	73	43	77	44	69	43¾	88	57	70½	40½	69¼	1.30	1.65
1903	49¼	68½	46½	61	40	54½	41	53	40½	56½	39	55	1.17½	1.57½
1904	47⅛	69	49¼	58¾	45½	58½	42¾	59½	42	60	42½	57	1.25	1.55
1905	50¾	63½	42	65	44½	59½	42	64½	44¾	59	41½	58½	1.25	1.55
1906	47	61½	45⅝	58	42	55½	39	54¾	43	55	39½	54¼	......	......
1907	49½	77	47	74¼	43	71	39¾	66½	43	69½	39	66	1.25	1.60
1908.														
January	63½	69½	59⅞	65¾	55½	56	57[3]	60	54½	59½	54¼	57½	......	......
February	60½	63¼	59⅜	61½	54½	60½	56½	59½	53½	61½	54¼	59	......	......
March	62½	70	62	66⅞	60½	66½	58½	66	61½	65½	58½	64½	1.60	1.70
April	69¼	75	66½	71	66½	69½	65	68	65	68½	63	67	1.65	1.70
May	72½	77½	71¼	74½	69½	76	67¾	82	69	75	67	73¾	1.65	1.80
June	74½	78	73½	76	70½	74½	67¼	74¼	71½	75	70½	75	1.80	1.87½
July	78¼	85	75½	80	71	81½	70½	78	72	79	74	81¼	1.80	1.90
August	85	90½	80	83½	76½	82	77½	80	78½	80	76	79½	1.85	1.90
September	......	......	......	......	79½	83½	78	82	80	83	76½	81½	......	......
October	......	......	......	......	66½	79½	66	79	75	80	63½	77	1.85	1.90
November	71	74	67¾	71	63	66	62	66½	63	72	61	66½	......	......
December	65	71	63⅛	67½	58½	64	56¾	62¼	59	63	56¼	63	......	......
Year	60½	90½	59⅜	83½	54½	83½	56½	82	53½	83	54¼	81½	1.60	1.90
1909.														
January	66¼	68½	64½	67	61	62½	58¼	60¾	60½	62½	58	62	1.72½	1.75
February	68¾	73	67⅛	71¾	61½	68½	61	65½	62½	67½	61	65	......	......
March	72½	74¾	70½	73¼	66½	69	64	67½	66¼	68½	64¼	67¼	......	......
April	74¼	80	72⅞	79	68½	76½	66½	72½	68	75	66	74½	1.90	1.95
May	80	82	78⅞	82	76	78	72¼	76	75	79	73	77	1.85	1.95
June	79	83	76⅜	81¼	74	77	71½	77	75¾	77½	71½	75½	......	......
July	77	80	74	77½	72	75½	68	74¼	73	75½	67½	74½	......	......
August	79	79	72	76	69	74	66½	70	71¼	74	64	69	1.80	1.85
September	73	76	74	74½	65½	72	63	69¾	66	74	62¾	69½	......	......
October	68¾	72	64¾	68¼	61	66	59	62	62½	65	59	63¼	......	......
November	69½	73	64¼	69	57	63½	61¼	64½	60½	64	58	63	1.80	1.85
December	66	69½	63½	67¼	57	64	62½	66	59	63¼	58	63¾	1.75	1.85
Year	66	83	63½	82	57	78	58¼	77	59	79	58	77	1.72½	1.95
1910.														
January	69	74½	67	70½	63½	69½	62½	68	63½	68¼	63	68	1.75	1.85
February	68½	73¼	66¾	69⅝	61½	66	63	66½	63	66	63	65	1.80	1.85
March	64½	68½	62½	67	59	63½	60	65	59½	63	59½	63	1.75	1.80
April	62¼	65	60⅜	64½	58	63½	56½	61	58½	61½	59	64½	1.62½	1.75
May	65½	69	61½	64½	60	66	56	63	58	64	59	66½	1.65	1.75
June	65	69	61	63	60½	63	57½	60½	60	63½	58½	62	1.60	1.67½
July	67	73	62	70½	62	67½	59¾	66¼	62¾	64	59	67½	1.62½	1.72½
August	68	71	66	70¼	61½	67½	58¾	67½	62	67½	59	68	1.70	1.72½
September	60	65½	58	65½	53½	61½	50¾	60	53	61	51½	59	1.60	1.70
October	55½	61	54	58	49½	54½	47½	52½	51	53	48	54	1.62½	1.65
November	52¼	59	52	53½	50½	55½	47½	52	51½	53½	45	50½	1.40	1.45
December	51½	57	50	53¼	46	54	45½	50	46½	54	44	50½	1.40	1.45
Year	52	74	50	70½	46	69½	45½	68	46½	68¼	44	68	1.40	1.85
1911.														
January	[4]	[4]	50⅜	51¾	45½	49	45½	47¾	47	48	44	47	1.31¼	1.33¾
February	53½	55½	49¼	51¾	46½	48½	45½	48	46	47	43½	45½	1.31¼	1.36¼
March	[4]	[4]	48⅞	50⅝	46	49½	45½	48	45¾	48	44	47½	1.31¼	1.36¼
April	58¼	61¼	49½	57	47	56½	46	53¼	46½	54½	45	52¾	1.40	1.42½
May	59¼	62⅝	56¾	61	53½	57	52¼	55¼	54½	56½	51¾	55	1.42½	1.48¼
June	60⅛	65¾	58½	63¼	55	60	53½	59¼	55	59	53¼	60½	1.47½	1.54¾
July	66	71½	63½	69	61½	70	59¾	67	59¾	68½	61	68½	1.65	1.67½
August	70	73¼	67½	70½	65	68½	62¾	65¼	64½	67	62½	66	1.60	1.67½
September	73¼	76	71¼	73½	65½	71½	65½	69	66	70½	63½	69	1.63¼	1.65
October	76½	81½	73¼	79	71	77½	69½	75	70½	76	68	74	1.63¾	1.80
November	78½	79½	69½	72¾	65	77	69	76	65	76	71	77	1.75	1.80
December	[4]	[4]	66½	70¼	61	70	68	71	61	65	62½	74	1.55	1.80
Year	53½	81½	48⅞	79	45½	77½	45½	76	45¾	76	43½	77	1.31¼	1.80

[1] No. 2 grade, 1898 to 1900. [2] No. 2 grade, 1898 to 1904. [3] Contract. [4] Nominal.

CORN—Continued.

Condition of the corn crop in the United States on the first of months named, 1891–1911.

Year.	July.	Aug.	Sept.	Oct.	Year.	July.	Aug.	Sept.	Oct.	Year.	July.	Aug.	Sept.	Oct.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1891	92.8	90.8	91.1	92.5	1898	90.5	87.0	84.1	82.0	1905	87.3	89.0	89.5	89.2
1892	81.1	82.5	79.6	79.8	1899	86.5	89.9	85.2	82.7	1906	87.5	88.0	90.2	90.1
1893	93.2	87.0	76.7	75.1	1900	89.5	87.5	80.6	78.2	1907	80.2	82.8	80.2	78.0
1894	95.0	69.1	63.4	64.2	1901	81.3	54.0	51.7	52.1	1908	82.8	82.5	79.4	77.8
1895	99.3	102.5	96.4	95.5	1902	87.5	86.5	84.3	79.6	1909	89.3	84.4	74.6	73.8
1896	92.4	96.0	91.0	90.5	1903	79.4	78.7	80.1	80.8	1910	85.4	79.3	78.2	80.3
1897	82.9	84.2	79.3	77.1	1904	86.4	87.3	84.6	83.9	1911	80.1	69.6	70.3	70.4

Average farm price of corn per bushel on the first of each month, 1910 and 1911.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	48.2	62.3	59.6	72.5	71.7	81.8	41.5	56.3	38.3	54.9	59.9	72.4	73.1	90.7
February	49.0	65.2	59.3	74.2	73.1	85.5	42.6	60.3	39.4	56.7	59.9	75.5	72.3	89.4
March	48.9	65.9	59.3	76.0	72.4	87.5	41.8	60.5	39.3	56.2	61.0	78.2	71.7	91.5
April	49.7	65.5	58.4	76.2	73.3	88.8	42.4	58.7	40.2	55.5	62.1	79.7	71.9	92.0
May	51.8	63.5	59.2	73.9	74.4	88.8	45.6	55.8	42.4	52.8	63.1	79.2	80.2	88.1
June	55.1	65.2	64.2	74.5	78.1	89.6	49.5	57.0	45.7	55.4	65.4	80.7	80.9	89.3
July	60.0	66.2	65.4	73.9	80.7	90.7	53.1	58.8	51.9	56.9	69.9	80.2	89.2	85.1
August	65.8	67.2	71.2	74.9	85.5	90.4	59.3	60.4	59.3	59.1	74.7	79.1	89.4	84.2
September	65.9	66.3	72.8	75.1	87.4	89.4	61.4	60.6	57.5	58.4	74.4	75.7	86.7	91.5
October	65.7	61.1	73.3	72.4	84.1	85.5	62.2	55.7	58.1	53.3	72.8	69.0	85.0	86.1
November	64.7	52.6	71.2	65.5	79.7	76.1	59.7	47.6	58.9	44.0	72.3	61.2	79.2	81.5
December	61.8	48.8	71.4	61.0	78.8	72.9	56.5	41.7	56.3	40.1	69.7	58.7	82.1	76.5

International trade in corn, including corn meal, 1906–1910.

General Note.—Substantially the international trade of the world. It should not be expected that the world export and import totals for any year will agree. Among sources of disagreement are these: (1) Different periods of time covered in the "year" of the various countries; (2) imports received in year subsequent to year of export; (3) want of uniformity in classification of goods among countries; (4) different practices and varying degrees of failure in recording countries of origin and ultimate destination; (5) different practices of recording reexported goods; (6) opposite methods of treating free ports; (7) clerical errors, which, it may be assumed, are not infrequent.

The exports given are domestic exports, and the imports given are imports for consumption as far as it is feasible and consistent so to express the facts. While there are some inevitable omissions, on the other hand, there are some duplications because of reshipments that do not appear as such in official reports. For the United Kingdom import figures refer to imports for consumption, when available, otherwise total imports less exports of "foreign and colonial merchandise." Figures for the United States include Alaska, Porto Rico, and Hawaii.

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	106,047,790	50,262,705	67,390,728	89,499,359	104,727,358
Austria-Hungary	Jan. 1	22,361	120,144	381,821	48,218	1,069,219
Belgium	Jan. 1	6,588,557	7,644,848	6,134,920	7,088,377	7,581,987
Bulgaria	Jan. 1	5,658,543	10,225,452	4,393,880	5,009,230	4,822,817
Netherlands	Jan. 1	6,010,176	8,215,931	6,957,524	7,308,873	5,101,056
Roumania	Jan. 1	23,756,349	54,721,194	28,960,339	29,091,585	[1] 29,091,585
Russia	Jan. 1	9,879,982	38,636,221	23,545,045	26,535,758	[2] 17,680,440
Servia	Jan. 1	1,755,446	4,046,392	1,934,483	3,767,180	[1] 3,767,180
United States	Jan. 1	105,258,629	86,524,012	39,013,273	38,114,098	44,072,209
Uruguay	July 1	9,746	88,659	25,432	[3] 775,566	[3] 153,968
Other countries		2,713,077	5,214,098	9,455,000	13,509,000	[2] 12,624,000
Total		267,700,656	265,699,656	188,192,445	220,747,244	230,691,819

[1] Year preceding. [2] Preliminary. [3] Year beginning Jan. 1.

CORN—Continued.

International trade in corn, including corn meal, 1906–1910—Continued.

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Austria-Hungary	Jan. 1	7,198,839	4,002,712	3,106,663	4,050,645	2,494,032
Belgium	Jan. 1	20,125,507	23,505,832	19,158,096	22,099,848	25,035,630
British South Africa	Jan. 1	315,835	51,298	145,275	155,390	69,463
Canada	Jan. 1	12,714,257	16,187,579	6,812,833	7,563,688	10,767,402
Cuba	Jan. 1	2,489,087	3,153,495	1,837,974	2,249,996	3,002,432
Denmark	Jan. 1	18,855,752	17,855,141	10,445,555	9,151,749	7,217,422
Egypt	Jan. 1	1,438,435	196,539	845,205	748,865	83,038
France	Jan. 1	14,509,103	16,850,618	9,629,979	11,213,413	15,348,323
Germany [1]	Jan. 1	44,883,052	49,293,029	26,372,295	27,833,917	22,562,742
Italy	Jan. 1	8,666,763	2,815,120	2,987,496	8,459,986	15,756,324
Mexico	Jan. 1	1,882,218	1,554,145	179,157	1,167,733	8,907,181
Netherlands	Jan. 1	25,305,233	29,192,195	25,261,400	22,914,269	21,511,620
Norway	Jan. 1	718,276	1,937,926	809,841	965,347	788,600
Portugal	Jan. 1	370,611	577,726	2,015,388	2,367,800	518,042
Russia	Jan. 1	456,481	550,841	355,769	212,817	[2] 72,870
Spain	Jan. 1	2,647,975	4,552,178	3,320,040	6,411,009	7,526,303
Sweden	Jan. 1	564,946	330,588	488,077	272,284	277,160
Switzerland	Jan. 1	2,887,291	2,867,764	2,480,164	3,143,216	3,605,403
United Kingdom	Jan. 1	97,736,853	106,708,048	68,186,271	78,057,366	73,486,852
Other countries		4,812,269	3,163,038	2,909,000	3,493,000	[2] 2,891,000
Total		268,578,783	285,345,812	187,346,478	212,532,338	221,921,839

[1] Not including free ports prior to Mar. 1, 1906. [2] Year beginning Jan. 1.

WHEAT.

Wheat area of countries named, 1907–1911.

Country.	1907	1908	1909	1910	1911
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	45,211,000	47,557,000	44,261,000	45,681,000	49,543,000
Canada:					
New Brunswick	20,600	20,200	19,600	19,500	13,200
Ontario	820,700	812,400	705,800	729,500	941,300
Manitoba	2,789,500	2,957,000	2,808,000	3,014,400	2,979,700
Saskatchewan	2,047,700	2,396,000	3,685,000	4,848,000	4,704,700
Alberta	207,900	271,000	385,000	533,000	1,616,900
Other	164,000	153,700	147,000	150,400	118,200
Total Canada	6,050,400	6,610,300	7,750,400	9,294,800	10,374,000
Mexico	(1)	(1)	(1)	2,627,600	(1)
SOUTH AMERICA.					
Argentina	14,065,600	14,232,900	14,981,900	14,422,100	15,451,600
Chile	(1)	1,142,800	1,106,600	1,179,300	(1)
Uruguay	623,300	611,800	683,900	(1)	636,600
EUROPE.					
Austria-Hungary:					
Austria	2,914,500	2,959,600	2,942,100	2,998,800	3,002,500
Hungary proper	8,069,300	8,715,000	8,036,500	8,584,400	8,352,600
Croatia-Slavonia	708,000	758,800	762,200	804,400	808,400
Bosnia-Herzegovina	247,900	272,100	205,100	247,100	192,800
Total Austria-Hungary	11,939,700	12,705,500	11,945,900	12,634,700	12,356,300

[1] No official statistics of area.

WHEAT—Continued.

Wheat area of countries named, 1907-1911—Continued.

Country.	1907	1908	1909	1910	1911
EUROPE—continued.	Acres.	Acres.	Acres.	Acres.	Acres.
Belgium	392,500	377,600	389,800	(1)	(1)
Bulgaria	2,414,700	2,422,700	2,570,200	2,690,200	(1)
Denmark	100,100	(1)	(1)	(1)	(1)
Finland	(1)	(1)	(1)	(1)	(1)
France	16,253,200	16,220,600	16,299,300	16,198,300	15,903,900
Germany	4,316,400	4,656,900	4,525,400	4,800,900	4,878,200
Greece	(1)	(1)	(1)	(1)	(1)
Italy	12,923,200	12,621,100	11,635,900	11,758,500	11,741,200
Montenegro	(1)	(1)	(1)	(1)	(1)
Netherlands	134,500	139,000	126,700	135,300	140,700
Norway	12,400	(1)	(1)	(1)	(1)
Portugal	(1)	(1)	(1)	(1)	1,211,200
Roumania	4,236,100	4,452,000	4,173,000	4,814,000	4,769,400
Russia:					
Russia proper	45,574,000	46,607,700	47,406,400		
Poland	1,245,700	1,218,700	1,227,200		
Northern Caucasia	8,124,900	7,958,600	8,376,800		
Total Russia (European)	54,944,600	55,785,000	57,010,400	62,620,900	
Servia	908,400	931,300	(1)	(1)	(1)
Spain	9,137,700	9,283,000	9,347,200	9,413,200	9,705,800
Sweden	216,900	224,900	228,600	332,400	241,000
Switzerland	(1)	(1)	(1)	(1)	(1)
Turkey (European)	(1)	(1)	(1)	1,061,200	(1)
United Kingdom:					
Great Britain—					
England	1,537,200	1,548,700	1,734,200	1,716,600	1,804,000
Scotland	48,300	43,400	49,700	52,800	63,500
Wales	39,900	34,600	39,600	39,400	38,500
Ireland	38,200	36,700	43,600	47,600	45,100
Total United Kingdom	1,663,600	1,663,400	1,867,100	1,856,400	1,951,100
ASIA.					
British India, including such native States as report	29,212,500	22,824,500	26,149,300	28,017,500	29,554,500
Cyprus	(1)	(1)	(1)	(1)	(1)
Japanese Empire:					
Japan	1,088,200	1,101,800	1,106,200	1,165,200	(1)
Formosa	(1)	(1)	(1)	(1)	(1)
Persia	(1)	(1)	(1)	(1)	(1)
Russia:					
Central Asia	2,016,200	2,155,200	3,322,200		
Siberia	3,868,300	4,470,700	5,073,100		
Transcaucasia	8,100	7,800	9,000		
Total Russia (Asiatic)	5,892,600	6,633,700	8,404,300	8,442,000	(1)
Turkey (Asiatic)	(1)	(1)	(1)	(1)	(1)
AFRICA.					
Algeria	3,257,400	3,597,000	2,814,200	3,426,500	3,554,400
Egypt	1,264,600	1,212,600	1,296,700	1,299,300	(1)
Tunis	1,099,600	1,084,800	956,300	1,112,000	(1)
Union of South Africa	(1)	(1)	(1)	(1)	(1)
AUSTRALASIA.					
Australia:					
Queensland	114,600	82,500	80,900	117,200	106,700
New South Wales	1,866,200	1,390,200	1,394,100	1,990,200	2,128,800
Victoria	2,031,900	1,847,100	1,779,900	2,097,200	2,398,100
South Australia	1,686,400	1,730,500	1,693,500	1,895,700	2,104,700
Western Australia	250,300	279,600	285,000	448,900	581,900
Tasmania	32,800	30,800	29,100	37,100	52,200
Total Australia	5,982,200	5,360,700	5,262,500	6,586,300	7,372,400
New Zealand	212,100	193,000	252,400	311,000	216,000
Total Australasia	6,194,300	5,553,700	5,514,900	6,897,300	7,588,400

[1] No official statistics of area.

WHEAT—Continued.

Wheat crop of countries named, 1907-1911.

Country.	1907	1908	1909	1910	1911
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	634,087,000	664,602,000	683,350,000	635,121,000	621,338,000
Canada:					
New Brunswick	411,000	349,000	395,000	371,000	270,000
Ontario	18,019,000	18,057,000	16,262,000	17,805,000	19,252,000
Manitoba	39,688,000	50,269,000	52,706,000	41,159,000	60,275,000
Saskatchewan	27,692,000	34,742,000	85,197,000	81,139,000	97,665,000
Alberta	4,194,000	6,842,000	9,579,000	6,593,000	36,143,000
Other	2,687,000	2,175,000	2,605,000	2,923,000	2,246,000
Total Canada	92,691,000	112,434,000	166,744,000	149,990,000	215,851,000
Mexico	10,000,000	10,000,000	10,000,000	11,976,000	12,000,000
Total	736,778,000	787,036,000	860,094,000	797,087,000	849,189,000
SOUTH AMERICA.					
Argentina	155,991,000	192,487,000	156,162,000	131,010,000	145,981,000
Chile	15,776,000	18,967,000	17,743,000	19,743,000	18,000,000
Uruguay	6,867,000	7,430,000	8,595,000	7,750,000	6,009,000
Total	178,634,000	218,884,000	182,500,000	158,503,000	169,990,000
EUROPE.					
Austria-Hungary:					
Austria	52,369,000	62,129,000	58,468,000	57,589,000	58,880,000
Hungary proper	120,509,000	152,205,000	113,352,000	169,700,000	175,030,000
Croatia-Slavonia	10,170,000	13,220,000	11,662,000	11,434,000	15,210,000
Bosnia-Herzegovina	2,169,000	3,023,000	2,594,000	2,671,000	2,941,000
Total Austria-Hungary	185,217,000	230,577,000	186,076,000	241,394,000	252,061,000
Belgium	15,835,000	13,393,000	14,603,000	12,449,000	14,616,000
Bulgaria	23,545,000	36,496,000	32,071,000	42,247,000	48,000,000
Denmark	4,343,000	4,318,000	3,829,000	4,547,000	4,469,000
Finland	140,000	111,000	134,000	125,000	125,000
France	376,999,000	317,765,000	356,193,000	257,667,000	315,444,000
Germany	127,843,000	138,442,000	138,000,000	141,884,000	149,411,000
Greece	8,000,000	8,000,000	7,000,000	7,000,000	8,000,000
Italy	177,543,000	152,236,000	189,959,000	153,168,000	192,395,000
Montenegro	200,000	200,000	200,000	200,000	200,000
Netherlands	5,325,000	5,121,000	4,158,000	4,371,000	5,648,000
Norway	290,000	333,000	313,000	294,000	271,000
Portugal	7,000,000	8,000,000	8,000,000	9,000,000	11,850,000
Roumania	42,257,000	54,813,000	56,751,000	110,761,000	90,886,000
Russia:					
Russia proper	340,416,000	383,016,000	586,819,000		
Poland	18,173,000	21,182,000	21,194,000		
Northern Caucasia	79,184,000	84,964,000	103,465,000		
Total Russia (European)	437,773,000	489,162,000	711,478,000	699,413,000	447,016,000
Servia	8,375,000	11,495,000	13,962,000	12,000,000	13,000,000
Spain	100,331,000	119,970,000	144,105,000	137,448,000	148,495,000
Sweden	6,279,000	6,756,000	6,978,000	7,450,000	7,945,000
Switzerland	4,000,000	3,527,000	3,568,000	2,756,000	3,524,000
Turkey (European)	18,000,000	20,000,000	20,000,000	19,462,000	20,000,000
United Kingdom:					
Great Britain—					
England	53,855,000	51,371,000	60,121,000	53,464,000	60,729,000
Scotland	1,953,000	1,854,000	2,111,000	2,020,000	2,786,000
Wales	1,138,000	966,000	1,147,000	1,122,000	1,118,000
Ireland	1,367,000	1,438,000	1,809,000	1,716,000	1,656,000
Total United Kingdom	58,313,000	55,629,000	65,188,000	58,322,000	66,289,000
Total	1,607,608,000	1,676,344,000	1,962,566,000	1,921,958,000	1,799,645,000

WHEAT—Continued.

Wheat crop of countries named, 1907–1911—Continued.

Country.	1907	1908	1909	1910	1911
ASIA.					
British India, including such native States as report	*Bushels.* 317,023,000	*Bushels.* 227,983,000	*Bushels.* 284,361,000	*Bushels.* 358,049,000	*Bushels.* 369,630,000
Cyprus	2,636,000	2,556,000	1,912,000	2,238,000	1,963,000
Japanese Empire:					
Japan	22,795,000	22,587,000	22,966,000	24,487,000	24,820,000
Formosa	200,000	200,000	200,000	200,000	200,000
Total Japanese Empire	22,995,000	22,787,000	23,166,000	24,687,000	25,020,000
Persia	16,000,000	16,000,000	16,000,000	16,000,000	16,000,000
Russia:					
Central Asia	27,085,000	21,416,000	26,429,000		
Siberia	45,771,000	55,755,000	45,269,000		
Transcaucasia	63,000	66,000	94,000		
Total Russia (Asiatic)	72,919,000	77,237,000	71,792,000	76,282,000	62,475,000
Turkey (Asiatic)	35,000,000	35,000,000	35,000,000	35,000,000	35,000,000
Total	466,573,000	381,563,000	432,231,000	512,256,000	510,088,000
AFRICA.					
Algeria	31,261,000	29,739,000	34,769,000	39,374,000	35,874,000
Egypt	30,000,000	30,000,000	30,000,000	32,623,000	37,932,000
Tunis	6,314,000	3,674,000	6,430,000	5,512,000	5,000,000
Union of South Africa	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000
Total	70,075,000	65,913,000	73,699,000	80,009,000	81,306,000
AUSTRALASIA.					
Australia:					
Queensland	1,144,000	715,000	1,241,000	1,621,000	1,055,000
New South Wales	22,506,000	9,444,000	15,971,000	29,431,000	28,793,000
Victoria	23,331,000	12,482,000	24,081,000	29,687,000	35,910,000
South Australia	18,017,000	19,739,000	20,009,000	25,926,000	25,112,000
Western Australia	2,845,000	3,018,000	2,538,000	5,779,000	6,083,000
Tasmania	672,000	665,000	723,000	819,000	1,156,000
Total Australia	68,515,000	46,063,000	64,563,000	93,263,000	98,109,000
New Zealand	5,782,000	5,743,000	9,049,000	9,008,000	8,535,000
Total Australasia	74,297,000	51,806,000	73,612,000	102,271,000	106,644,000
Grand total	3,133,965,000	3,181,547,000	3,584,702,000	3,572,084,000	3,516,862,000

Average yield of wheat in countries named, bushels per acre, 1890–1911.

Year.	United States.	Russia European.[1]	Germany.[1]	Austria.[1]	Hungary proper.[1]	France.[2]	United Kingdom.[2]
Average (1890–1899)	13.2	8.9	24.5	16.2		18.6	31.2
Average (1900–1909)	14.1	9.7	28.9	18.0	17.5	20.5	33.1
1902	14.5	11.1	30.3	19.0	20.7	20.2	33.9
1903	12.9	10.6	29.2	17.8	19.0	22.8	31.1
1904	12.5	11.5	29.5	19.5	16.3	18.5	27.8
1905	14.5	10.0	28.5	19.6	18.7	20.9	33.9
1906	15.5	7.7	30.3	20.3	22.5	20.2	34.8
1907	14.0	8.0	29.6	18.0	14.9	23.2	35.1
1908	14.0	8.8	29.7	21.0	17.5	19.6	33.4
1909	15.4	12.5	30.5	19.9	14.1	21.9	35.0
1910	13.9	11.2	29.6	19.5	19.8	15.9	31.4
1911	12.5		30.6	19.6	21.0	20.1	34.0
Average (1902–1911)	14.0		29.8	19.4	18.4	20.3	33.0

[1] Bushels of 60 pounds. [2] Winchester bushels.

WHEAT—Continued.

Acreage, production, value, prices, and exports of wheat in the United States, 1849–1911.

Year.	Acreage harvested.	Average yield per acre.	Production.	Average farm price per bushel December 1.	Farm value December 1.	Chicago cash price per bushel, No. 1 northern. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, including flour, fiscal year beginning July 1.	Per cent of crop exported.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*P. ct.*
1849 [1]			*100,486,000*							*7,535,901*	*7.5*
1859 [1]			*173,105,000*							*17,213,133*	*9.9*
1866	15,424,000	9.9	152,000,000	152.7	232,110,000	129	145	185	211	12,646,941	8.3
1867	18,322,000	11.6	212,441,000	145.2	308,387,000	126	140	134	161	26,323,014	12.4
1868	18,460,000	12.1	224,037,000	108.5	243,033,000	80	88	87	96	29,717,201	13.3
1869	19,181,000	13.6	260,147,000	76.5	199,025,000	63	76	79	92	53,900,780	20.7
1869 [1]			*287,746,000*								
1870	18,993,000	12.4	235,885,000	94.4	222,767,000	91	98	113	120	52,574,111	22.3
1871	19,944,000	11.6	230,722,000	114.5	264,076,000	107	111	120	143	38,995,755	16.9
1872	20,858,000	12.0	249,997,000	111.4	278,522,000	97	108	112	122	52,014,715	20.8
1873	22,172,000	12.7	281,255,000	106.9	300,670,000	96	106	105	114	91,510,398	32.5
1874	24,967,000	12.3	308,103,000	86.3	265,881,000	78	83	78	94	72,912,817	23.7
1875	26,382,000	11.1	292,136,000	89.5	261,397,000	82	91	89	100	74,750,682	25.6
1876	27,627,000	10.5	289,356,000	97.0	280,743,000	104	117	130	172	57,043,936	19.7
1877	26,278,000	13.9	364,194,000	105.7	385,089,000	103	108	98	113	92,141,626	25.3
1878	32,109,000	13.1	420,122,000	77.6	325,814,000	81	84	91	102	150,502,506	35.8
1879	32,546,000	13.8	448,757,000	110.8	497,030,000	122	133½	112½	119	180,304,181	40.2
1879 [1]	*35,430,000*	*13.9*	*459,483,000*								
1880	37,987,000	13.1	498,550,000	95.1	474,202,000	93½	109¾	101	112⅝	186,321,514	37.4
1881	37,709,000	10.2	383,280,000	119.2	456,880,000	124¾	129	123	140	121,892,389	31.8
1882	37,067,000	13.6	504,185,000	88.4	445,602,000	91⅛	94¾	108	113⅜	147,811,316	29.3
1883	36,456,000	11.6	421,086,000	91.1	383,649,000	94⅝	99¼	85	94¾	111,534,182	26.5
1884	39,476,000	13.0	512,765,000	64.5	330,862,000	69½	76⅜	85⅜	90¾	132,570,366	25.9
1885	34,189,000	10.4	357,112,000	77.1	275,320,000	82⅞	89	72⅛	79	94,565,793	26.5
1886	36,806,000	12.4	457,218,000	68.7	314,226,000	75⅛	79½	80¾	88¾	153,804,969	33.6
1887	37,642,000	12.1	456,329,000	68.1	310,613,000	75⅛	79¼	81¼	89⅞	119,625,344	26.2
1888	37,336,000	11.1	415,868,000	92.6	385,248,000	96⅝	105½	77¼	95½	88,600,743	21.3
1889	38,124,000	12.9	490,560,000	69.8	342,492,000	76¾	80½	89¾	100	109,430,467	22.3
1889 [1]	*33,580,000*		*468,374,000*								
1890	36,087,000	11.1	399,262,000	83.8	334,774,000	87½	92¾	98⅞	108¼	106,181,316	26.6
1891	39,917,000	15.3	611,780,000	83.9	513,473,000	89⅜	93¼	80	85¾	225,665,811	36.9
1892	38,554,000	13.4	515,949,000	62.4	322,112,000	69½	73	68¼	76¼	191,912,635	37.2
1893	34,629,000	11.4	396,132,000	53.8	213,171,000	59⅛	64½	52⅛	60½	164,283,129	41.5
1894	34,882,000	13.2	460,267,000	49.1	225,902,000	52¾	63⅝	60¾	85⅜	144,812,718	31.5
1895	34,047,000	13.7	467,103,000	50.9	237,939,000	53¾	64¾	57⅛	67⅝	126,443,968	27.1
1896	34,619,000	12.4	427,684,000	72.6	310,598,000	74⅝	93⅛	68¾	97⅞	145,124,972	33.9
1897	39,465,000	13.4	530,149,000	80.8	428,547,000	92	109	117	185	217,306,005	41.0
1898	44,055,000	15.3	675,149,000	58.2	392,770,000	62¾	70	68⅜	79½	222,618,420	33.0
1899	44,593,000	12.3	547,304,000	58.4	319,545,000	64	69½	63⅝	67½	186,096,762	34.0
1899 [1]	*52,589,000*	*12.5*	*658,534,000*								
1900	42,495,000	12.3	522,230,000	61.9	323,515,000	69¼	74⅝	70	75⅛	215,990,073	41.4
1901	49,896,000	15.0	748,460,000	62.4	467,360,000	73	79½	72⅜	76¼	234,772,516	31.4
1902	46,202,000	14.5	670,063,000	63.0	422,224,000	71⅞	77¾	74¾	80⅝	202,905,598	30.3
1903	49,465,000	12.9	637,822,000	69.5	443,025,000	77¾	87	87¾	101½	120,727,613	18.9
1904	44,075,000	12.5	552,400,000	92.4	510,490,000	115	122	89½	113¾	44,112,910	8.0
1905	47,854,000	14.5	692,979,000	74.8	518,373,000	82½	90	80¼	87¼	97,609,007	14.1
1906	47,306,000	15.5	735,261,000	66.7	490,333,000	[2] 72⅝	[2] 75	84	106	146,700,425	20.0
1907	45,211,000	14.0	634,087,000	87.4	554,437,000	[2] 104¼	[2] 109	[2] 103	[2] 111¼	163,043,669	25.7
1908	47,557,000	14.0	664,602,000	92.8	616,826,000	106½	112	126½	137	114,268,468	17.2
1909	46,723,000	15.8	737,189,000	99.0	730,046,000	106	119¾	100	119¼	87,364,318	11.9
1909 [1]	*44,261,000*	*15.4*	*683,350,000*								
1910 [3]	45,681,000	13.9	635,121,000	88.3	561,051,000	104	110	98	106	69,311,760	10.9
1911 [3]	49,543,000	12.5	621,338,000	87.4	543,063,000	105	110				

[1] Census figures.
[2] No. 2, red winter.
[3] Figures adjusted to census basis.

WHEAT—Continued.

Acreage, production, and farm value December 1 of winter and spring wheat, by States, in 1911, and United States totals, 1890 to 1910.

State and year.	Winter wheat.					Spring wheat.				
	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bu.*	*Bushels.*	*Cts.*	*Dollars.*	*Acres.*	*Bu.*	*Bushels.*	*Cts.*	*Dollars.*
Me						3,000	21.0	63,000	110.0	69,000
Vt						1,000	27.8	28,000	99.0	28,000
N. Y	345,000	19.5	6,728,000	95.0	6,392,000					
N. J	84,000	17.4	1,462,000	96.0	1,404,000					
Pa	1,289,000	13.5	17,402,000	92.0	16,010,000					
Del	113,000	16.7	1,887,000	90.0	1,698,000					
Md	605,000	15.5	9,378,000	91.0	8,534,000					
Va	750,000	12.0	9,000,000	96.0	8,640,000					
W. Va	238,000	11.5	2,737,000	102.0	2,792,000					
N. C	626,000	10.6	6,636,000	102.0	6,769,000					
S. C	83,000	11.4	946,000	123.0	1,164,000					
Ga	145,000	12.0	1,740,000	114.0	1,984,000					
Ohio	2,265,000	16.0	36,240,000	91.0	32,978,000					
Ind	2,337,000	14.7	34,354,000	89.0	30,575,000					
Ill	2,625,000	16.0	42,000,000	89.0	37,380,000					
Mich	1,025,000	18.0	18,450,000	88.0	16,236,000					
Wis	90,000	17.5	1,575,000	90.0	1,418,000	105,000	14.5	1,522,000	90.0	1,370,000
Minn						4,350,000	10.1	43,935,000	92.0	40,420,000
Iowa	287,000	19.7	5,654,000	88.0	4,976,000	360,000	13.8	4,968,000	88.0	4,372,000
Mo	2,300,000	15.7	36,110,000	88.0	31,777,000					
N. Dak						9,150,000	8.0	73,200,000	89.0	65,148,000
S. Dak						3,700,000	4.0	14,800,000	91.0	13,468,000
Nebr	2,788,000	13.8	38,474,000	87.0	33,472,000	310,000	10.0	3,100,000	87.0	2,697,000
Kans	4,725,000	10.8	51,030,000	91.0	46,437,000	85,000	4.2	357,000	91.0	325,000
Ky	780,000	12.7	9,906,000	92.0	9,114,000					
Tenn	720,000	11.5	8,280,000	96.0	7,949,000					
Ala	30,000	11.5	345,000	120.0	414,000					
Miss	9,000	12.0	108,000	100.0	108,000					
Tex	700,000	9.4	6,580,000	100.0	6,580,000					
Okla	1,122,000	8.0	8,976,000	92.0	8,258,000					
Ark	96,000	10.5	1,008,000	90.0	907,000					
Mont	229,000	31.7	7,259,000	77.0	5,589,000	200,000	25.2	5,040,000	77.0	3,881,000
Wyo	24,000	26.0	624,000	94.0	587,000	45,000	26.0	1,170,000	94.0	1,100,000
Colo	178,000	18.0	3,204,000	84.0	2,691,000	260,000	19.5	5,070,000	84.0	4,259,000
N. Mex	30,000	25.0	750,000	100.0	750,000	25,000	20.5	512,000	100.0	512,000
Ariz	25,000	30.0	750,000	95.0	712,000	2,000	25.0	50,000	95.0	48,000
Utah	150,000	20.0	3,000,000	70.0	2,100,000	75,000	27.0	2,025,000	70.0	1,418,000
Nev	16,000	23.0	368,000	95.0	350,000	20,000	32.5	650,000	95.0	618,000
Idaho	347,000	31.5	10,930,000	66.0	7,214,000	170,000	29.0	4,930,000	66.0	3,254,000
Wash	920,000	27.3	25,116,000	71.0	17,832,000	1,310,000	19.5	25,545,000	71.0	18,137,000
Oreg	586,000	22.2	13,009,000	75.0	9,757,000	210,000	17.7	3,717,000	75.0	2,788,000
Cal	480,000	18.0	8,640,000	88.0	7,603,000					
U. S	29,162,000	14.8	430,656,000	88.0	379,151,000	20,381,000	9.4	190,682,000	86.0	163,912,000
1910	27,329,000	15.9	434,142,000	88.1	382,318,000	18,352,000	11.0	200,979,000	88.9	178,733,000
1909	28,330,000	15.8	446,366,000	102.9	459,154,000	18,393,000	15.8	290,823,000	93.1	270,892,000
1908	30,349,000	14.4	437,908,000	93.7	410,330,000	17,208,000	13.2	226,694,000	91.1	206,496,000
1907	28,132,000	14.6	409,442,000	88.2	361,217,000	17,079,000	13.2	224,645,000	86.0	193,220,000
1906	29,600,000	16.7	492,888,000	68.3	336,435,000	17,706,000	13.7	242,373,000	63.5	153,898,000
1905	29,864,000	14.3	428,462,000	78.2	334,987,000	17,990,000	14.7	264,517,000	69.3	183,386,000
1904	26,866,000	12.4	332,935,000	97.8	325,611,000	17,209,000	12.8	219,464,000	84.2	184,879,000
1903	32,511,000	12.3	399,867,000	71.6	286,243,000	16,954,000	14.0	237,955,000	65.9	156,782,000
1902	28,581,000	14.4	411,789,000	64.8	266,727,000	17,621,000	14.7	258,274,000	60.2	155,497,000
1901	30,240,000	15.2	458,835,000	66.1	303,227,000	19,656,000	14.7	289,626,000	56.7	164,133,000
1900	26,236,000	13.3	350,025,000	63.3	221,668,000	16,259,000	10.6	172,204,000	59.1	101,847,000
1899	25,358,000	11.5	291,706,000	63.0	183,767,000	19,235,000	13.3	255,598,000	53.1	135,778,000
1898	25,745,000	14.9	382,492,000	62.2	237,736,000	18,310,000	16.0	292,657,000	53.0	155,034,000
1897	22,926,000	14.1	323,616,000	85.1	275,323,000	16,539,000	12.5	206,533,000	74.2	153,224,000
1896	22,794,000	11.8	267,934,000	77.0	206,270,000	11,825,000	13.5	159,750,000	65.3	104,328,000
1895	22,609,000	11.6	261,242,000	57.8	150,944,000	11,438,000	18.0	205,861,000	42.3	86,995,000
1894	23,519,000	14.0	329,290,000	49.8	164,022,000	11,364,000	11.5	130,977,000	47.2	61,880,000
1893	23,118,000	12.0	278,469,000	56.3	156,720,000	11,511,000	10.2	117,662,000	48.0	56,451,000
1892	26,209,000	13.7	359,416,000	65.1	234,037,000	12,345,000	12.7	156,531,000	56.3	88,075,000
1891	27,524,000	14.7	405,116,000	88.0	356,415,000	12,393,000	16.7	206,665,000	76.0	157,058,000
1890	23,520,000	10.9	255,374,000	87.5	223,362,000	12,567,000	11.4	143,890,000	77.4	111,411,000

WHEAT—Continued.

Acreage, production, farm value, and distribution of wheat in the United States, by States, 1911–1909.

[Expressed in thousands; 000 omitted.]

State and Division.	Acreage.			Production.			Value, basis Dec. 1 price.			Farm reserves of old crop, July 1.		Shipped.[1]
	1911	1910	1909 (census).	1911	1910	1909 (census).	1911	1910	1909	1911	1910	
	Acres.	*Acres.*	*Acres.*	*Bush.*	*Bush.*	*Bush.*	*Dolls.*	*Dolls.*	*Dolls.*	*Bush.*	*Bush.*	*P. ct.*
Me.	3	3	4	63	89	85	69	91	94	4	7	0
Vt.	1	1	1	28	29	14	28	30	17	1	0	0
N. Y.	345	355	289	6,728	8,414	6,664	6,392	8,077	7,397	589	413	26
N. J.	84	84	84	1,462	1,554	1,489	1,404	1,523	1,623	107	94	31
Pa.	1,289	1,309	1,226	17,402	23,300	21,564	16,010	21,436	23,505	1,724	1,294	32
N. Atlantic.	1,722	1,752	1,604	25,683	33,386	29,816	23,903	31,157	32,636	2,425	1,808	30.3
Del.	113	116	111	1,887	1,972	1,644	1,698	1,775	1,709	79	66	65
Md.	605	604	590	9,378	10,510	9,463	8,534	9,669	10,410	526	379	60
Va.	750	748	693	9,000	9,574	8,077	8,640	9,287	9,289	574	323	30
W. Va.	238	241	209	2,737	3,012	2,576	2,792	3,072	2,911	166	142	24
N. C.	626	598	502	6,636	6,817	3,827	6,769	7,499	4,860	320	142	5
S. C.	83	77	43	946	847	311	1,164	1,067	453	30	8	1
Ga.	145	141	93	1,740	1,480	753	1,984	1,924	1,092	37	15	3
Fla.	......	......	......	......	......	......	......	......	......	......	......	......
S. Atlantic.	2,560	2,525	2,241	32,324	34,212	26,651	31,581	34,293	30,724	1,732	1,075	33.0
Ohio.	2,265	2,125	1,828	36,240	34,425	30,664	32,978	30,982	34,343	2,582	2,668	45
Ind.	2,337	2,256	2,083	34,354	35,194	33,936	30,575	30,619	37,330	2,112	1,866	55
Ill.	2,625	2,444	2,185	42,000	36,660	37,831	37,380	32,261	39,344	1,466	1,438	64
Mich.	1,025	936	802	18,450	16,848	16,026	16,236	14,995	17,949	1,348	1,010	50
Wis.	195	186	140	3,097	3,590	2,635	2,788	3,302	2,529	233	166	24
N. C. E. Miss. R.	8,447	7,947	7,038	134,141	126,717	121,092	119,957	112,159	131,495	7,741	7,148	53.7
Minn.	4,350	4,000	3,277	43,935	64,000	57,094	40,420	60,160	54,811	5,632	3,369	63
Iowa.	647	532	527	10,622	11,174	8,056	9,348	9,497	7,492	670	524	56
Mo.	2,300	1,881	2,017	36,110	25,958	29,837	31,777	22,583	31,329	1,480	1,731	52
N. Dak.	9,150	7,700	8,189	73,200	38,500	116,782	65,148	34,650	107,439	962	5,138	59
S. Dak.	3,700	3,650	3,217	14,800	46,720	47,060	13,468	41,581	42,354	1,869	2,777	48
Nebr.	3,098	2,394	2,663	41,574	38,760	47,686	36,169	31,008	42,440	3,101	3,290	64
Kans.	4,810	4,490	5,973	51,387	63,236	77,564	46,762	53,118	74,461	3,162	3,490	68
N. C. W. Miss. R.	28,055	24,647	25,863	271,628	288,348	384,079	243,092	252,597	360,326	16,876	20,319	60.5
Ky.	780	767	681	9,906	9,818	8,739	9,114	9,131	9,701	324	306	30
Tenn.	720	711	620	8,280	8,319	6,517	7,949	8,153	7,494	341	196	30
Ala.	30	28	14	345	336	114	414	380	148	13	3	4
Miss.	9	5	......	108	70	5	108	81	6	1	0	0
Tex.	700	700	326	6,580	10,500	2,561	6,580	10,290	3,022	147	51	49
Okla.	1,122	1,567	1,169	8,976	25,542	14,008	8,258	22,222	14,148	639	252	57
Ark.	96	87	61	1,008	1,209	526	907	1,136	579	62	21	15
S. Central.	3,457	3,865	2,871	35,203	55,794	32,470	33,330	51,393	35,098	1,527	829	39.7
Mont.	429	350	258	12,299	7,700	6,252	9,470	6,622	5,439	385	250	55
Wyo.	69	56	42	1,794	1,400	736	1,687	1,330	728	56	38	13
Colo.	438	403	341	8,274	8,994	7,224	6,950	7,376	6,718	603	491	44
N. Mex.	55	41	32	1,262	820	500	1,262	820	585	49	10	17
Ariz.	27	27	20	800	603	363	760	724	504	4	18	15
Utah.	225	198	179	5,025	4,370	3,944	3,518	3,671	3,550	319	363	35
Nev.	36	30	14	1,018	795	390	968	866	406	22	39	16
Idaho.	517	472	399	15,860	10,658	10,238	10,468	7,674	8,907	533	584	67
Wash.	2,230	2,101	2,118	50,661	35,571	40,920	35,969	27,746	38,056	818	2,005	80
Oreg.	796	717	763	16,726	15,853	12,457	12,545	13,317	11,585	555	735	65
Cal.	480	550	478	8,640	9,900	6,203	7,603	9,306	6,886	426	217	60
Far Western.	5,302	4,945	4,644	122,359	96,664	89,227	91,200	79,452	83,364	3,770	4,750	65.5
United States	49,543	45,681	[2]44,261	621,338	635,121	[2]683,350	543,063	561,051	673,643	34,071	35,929	56.1

[1] Percentage of 1911 crop which was shipped out of county of growth.
[2] Includes nearly 1,000 acres and 16,000 bushels in other States.

WHEAT—Continued.

Condition of the wheat crop in the United States on the first of months named, 1888–1912.

Year.	Winter wheat.						Spring wheat.			
	December of previous year.	April.	May.	June.	July.	When harvested.[1]	June.	July.	August.	When harvested.
	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
1888	95.9	82.0	73.1	73.3	75.6	77.3	92.8	95.9	87.3	....
1889	96.8	94.0	96.0	93.1	92.0	87.5	94.4	83.3	81.2	....
1890	95.3	81.0	80.0	78.1	76.2	75.5	91.3	94.4	83.2	....
1891	98.4	96.9	97.9	96.6	96.2	96.9	92.6	94.1	95.5	....
1892	85.3	81.2	84.0	88.3	89.6	85.3	92.3	90.9	87.3	....
1893	87.4	77.4	75.4	75.5	77.7	74.0	86.4	74.1	67.0	....
1894	91.5	86.7	81.4	83.2	83.9	83.7	88.0	68.4	67.1	....
1895	89.0	81.4	82.9	71.1	65.8	75.4	97.8	102.2	95.9	....
1896	81.4	77.1	82.7	77.9	75.6	74.6	99.9	93.3	78.9	....
1897	99.5	81.4	80.2	78.5	81.2	85.7	89.6	91.2	86.7	....
1898	....	86.7	86.5	90.8	85.7	86.7	100.9	95.0	96.5	....
1899	92.6	77.9	76.2	67.3	65.6	70.9	91.4	91.7	83.6	....
1900	97.1	82.1	88.9	82.7	80.8	69.6	87.3	55.2	56.4	....
1901	97.1	91.7	94.1	87.8	88.3	82.8	92.0	95.6	80.3	....
1902	86.7	78.7	76.4	76.1	77.0	80.0	95.4	92.4	89.7	....
1903	99.7	97.3	92.6	82.2	78.8	74.7	95.9	82.5	77.1	....
1904	86.6	76.5	76.5	77.7	78.7	....	93.4	93.7	87.5	66.2
1905	82.9	91.6	92.5	85.5	82.7	....	93.7	91.0	89.2	87.3
1906	94.1	89.1	90.9	82.7	85.6	....	93.4	91.4	86.9	83.4
1907	94.1	89.9	82.9	77.4	78.3	....	88.7	87.2	79.4	77.1
1908	91.1	91.3	89.0	86.0	80.6	....	95.0	89.4	80.7	77.6
1909	85.3	82.2	83.5	80.7	82.4	....	95.2	92.7	91.6	88.6
1910	95.8	80.8	82.1	80.0	81.5	....	92.8	61.6	61.0	63.1
1911	82.5	83.3	86.1	80.4	76.8	....	94.6	73.8	59.8	56.7
1912	86.6	....	....	....	....	....	....	....	....	....

[1] Includes both winter and spring.

Per cent of winter wheat area sown which was abandoned (not harvested).

Year.	Per cent.	Year.	Per cent.	Year.	Per cent.
1899	13.5	1904	15.4	1908	4.2
1900	11.8	1905	4.6	1909	7.2
1901	6.7	1906	5.5	1910	13.3
1902	15.2	1907	11.2	1911	9.0
1903	2.8				

WHEAT—Continued.

Average yield per acre and farm price per bushel of wheat in the United States.

State and Division.	Yield per acre.						Farm price per bushel.								
	10-year averages.				1910	1911	10-year averages for Dec. 1.				Dec. 1, 1910.	Quarterly, 1911.			
	1870-1879	1880-1889	1890-1899	1900-1909			1870-1879	1880-1889	1890-1899	1900-1909		Mar. 1.	June 1.	Sept. 1.	Dec. 1.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Maine	14.0	13.6	18.3	24.0	29.7	21.0	152	128	96	100	102	118	115	107	110
Vermont	16.6	16.9	20.6	21.9	29.3	27.8	139	117	91	98	103	99	.....	102	99
New York	14.8	14.7	17.2	17.4	23.7	19.5	126	102	82	90	96	88	89	87	95
New Jersey	14.3	12.8	15.0	16.8	18.5	17.4	131	104	82	89	98	91	96	91	96
Pennsylvania	13.8	12.6	15.3	16.5	17.8	13.5	123	99	77	87	92	90	90	86	92
North Atlantic	14.2	13.3	15.7	16.7	19.1	14.9	125.1	101.4	79.0	88.0	93.3	89.6	90.0	86.5	93.1
Delaware	12.2	11.6	14.0	16.0	17.0	16.7	128	100	77	86	90	89	89	89	90
Maryland	11.7	12.2	15.1	16.0	17.4	15.5	125	98	78	86	92	91	91	86	91
Virginia	8.5	8.0	9.9	10.6	12.8	12.0	115	97	76	90	97	97	94	92	96
West Virginia	10.7	10.0	11.0	11.2	12.5	11.5	111	94	78	92	102	100	100	99	102
North Carolina	7.4	6.0	7.0	8.2	11.4	10.6	119	106	84	101	110	108	104	100	102
South Carolina	6.9	5.7	6.7	8.1	11.0	11.4	163	119	98	114	126	117	112	115	123
Georgia	7.5	6.0	7.3	8.3	10.5	12.0	136	115	95	110	130	120	123	115	114
South Atlantic	9.0	8.3	10.2	11.2	13.5	12.6	121.9	101.0	80.0	93.0	100.2	100.5	98.9	96.0	97.7
Ohio	14.0	13.5	14.7	14.9	16.2	16.0	108	91	71	86	90	86	86	84	91
Indiana	13.0	13.1	13.3	14.2	15.6	14.7	100	87	69	84	87	85	85	82	89
Illinois	13.0	13.1	12.8	15.5	15.0	16.0	92	84	67	81	88	87	86	81	89
Michigan	14.7	15.3	14.7	14.5	18.0	18.0	109	88	72	84	89	84	84	80	88
Wisconsin	13.1	12.0	14.2	16.6	19.3	15.9	87	83	66	79	92	89	90	90	90
N. C. E. Miss. R.	13.5	13.4	13.5	14.9	15.9	15.9	98.6	87.2	69.3	83.1	88.5	85.8	85.5	82.3	89.4
Minnesota	14.3	12.6	14.4	13.0	16.0	10.1	77	75	62	76	94	88	88	92	92
Iowa	11.0	10.7	14.3	14.6	21.0	16.4	73	73	61	72	85	80	82	82	88
Missouri	12.2	11.8	11.4	13.4	13.8	15.7	92	80	64	78	87	87	84	79	88
North Dakota	....	13.0	13.1	12.1	5.0	8.0	....	64	56	72	90	85	87	90	89
South Dakota			10.7	12.1	12.8	4.0			55	71	89	84	85	89	91
Nebraska	12.5	11.0	12.1	17.5	16.2	13.4	67	64	55	67	80	74	77	79	87
Kansas	14.3	13.8	12.3	14.0	14.1	10.7	86	69	57	71	84	81	81	81	91
N. C. W. Miss. R.	12.6	11.9	12.7	13.5	11.7	9.7	77.8	72.3	58.2	72.3	87.6	83.6	84.2	86.1	89.5
Kentucky	10.4	9.4	11.6	11.5	12.8	12.7	98	89	71	87	93	90	90	83	92
Tennessee	7.8	6.6	9.4	9.6	11.7	11.5	101	91	74	90	98	98	97	89	96
Alabama	7.8	6.0	8.1	9.6	12.0	11.5	124	112	92	102	113	110	112	104	120
Mississippi	9.0	5.6	8.5	10.0	14.0	12.0	140	114	86	94	116	115	89	100	100
Texas	13.8	10.1	11.6	10.8	15.0	9.4	126	95	74	89	98	96	101	96	100
Oklahoma	....	.....	13.8	12.8	16.3	8.0	.....	.....	58	73	87	88	87	87	92
Arkansas	9.4	7.5	8.9	9.5	13.9	10.5	113	99	72	85	94	89	87	82	90
South Central	9.0	8.0	10.8	11.3	14.4	10.2	104.7	92.6	71.5	82.9	92.1	92.7	93.5	89.5	94.7
Montana	....	17.5	24.3	26.3	22.0	28.7	.....	87	67	73	86	82	82	80	77
Wyoming	.....	17.4	21.5	24.5	25.0	26.0	.....	88	68	80	95	98	93	96	94
Colorado	[1] 19.4	19.4	20.4	25.1	22.3	18.9	[1] 102	86	63	75	82	77	82	80	84
New Mexico	.....	13.6	17.5	21.2	20.0	22.9	.....	97	76	88	100	113	110	112	100
Arizona	.....	13.8	18.5	23.1	22.3	29.6	.....	94	78	106	120	89	91	95	95
Utah	.....	17.2	20.7	24.7	22.1	22.3	.....	75	62	75	84	75	73	67	70
Nevada	21.1	17.5	20.9	28.0	26.5	28.3	154	96	78	93	109	97	117	100	95
Idaho	.....	17.0	21.8	24.2	22.6	30.7	.....	86	61	69	72	65	72	64	66
Washington	.....	16.9	19.4	23.1	16.9	22.7	.....	73	58	69	78	70	77	69	71
Oregon	18.7	16.4	17.8	19.5	22.1	21.0	89	74	63	72	84	78	81	74	75
California	13.3	12.5	12.3	12.6	18.0	18.0	118	83	71	84	94	88	93	83	88
Far Western	14.1	14.1	15.5	19.1	19.5	23.1	112.2	81.2	66.0	74.2	82.2	77.2	81.5	74.9	74.5
United States	12.3	12.0	13.2	14.1	13.9	12.5	99.4	83.5	65.4	77.0	88.3	85.4	86.3	84.8	87.4

[1] The Territories.

WHEAT—Continued.

Wholesale prices of wheat per bushel, 1898–1911.

Date.	New York.		Baltimore.		Chicago.		Detroit.		St. Louis.		Minneapolis.		San Francisco.	
	No. 2 red winter.		Southern, No. 2 red.		No. 1 northern spring.[1]		No. 2 red.		No. 2 red winter.		No. 1 northern.[2]		No. 1 California (per 100 lbs.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.		
1898	68¾	193½	60	146½	62	185	65½	160	64	127	55	155	$1.08¾	$1.80¾
1899	72⅛	87½	68½	81½	64	79½	67½	80¼	68	81⅝	60	73⅞	.96¼	1.18½
1900	72⅞	96⅞	70	90	61½	87½	66¾	91½	66¼	86½	62	88⅞	.90	1.07
1901	72¾	89⅞	69¼	85¾	63⅛	79½	66½	90½	61¼	88½	60½	77½	.95	1.06¼
1902	73½	94¼	66¼	87½	67½	95	68½	93½	63	92½	66½	80⅜	1.05	1.45
1903	78¼	99⅞	76½	88¾	70¼	93	74¼	94	69¾	94	73⅛	100	1.32½	1.55
1904	92½	126¼	82	118½	81¼	122	92	123	89½	121	84¾	124½	1.23¾	1.50
1905	84⅜	125¾	73	119½	82½	124	80	124	82	120	75¼	124½	1.35	1.55
1906	77	97	68	91	71	87¼	72	93½	68⅛	99¼	69⅝	85⅜	......	......
1907	80	116¼	74	111¼	79	122	75	106½	74½	109½	76¾	119¾	1.22½	1.80½
1908.														
January	100	109¼	94¾	104	......	......	95¼	105	99	106¼	105⅝	114½	1.60	1.72½
February	96⅝	104⅜	92	100½	......	......	94½	103½	96	105½	101⅞	110¾	1.55	1.70
March	99¾	106¼	95½	99¾	105	108	94¾	103¾	97	106	103¼	111½	1.60	1.70
April	96⅝	109⅛	93¾	100½	105	107	92½	101½	96	102	98¾	108	1.60	1.70
May	103	111½	97½	103	......	......	97	104	100	106	106⅛	111⅞	1.63¾	1.75
June	95¾	103	89	99	107	112	89¾	97	89	101½	105⅝	110⅞	1.60	1.72½
July	96⅝	102¾	91	99	115	119	90	92½	89	93½	107¾	121	1.60	1.70
August	99⅝	105½	96	99⅝	108	124	93½	96	91½	97½	99⅞	125	1.65	1.72½
September	102¼	110¼	96⅞	104¼	105	109	96	101¾	97	106	100⅞	105⅝	1.65	1.77½
October	106¼	110⅝	101⅛	103½	102	108	100	103	100½	106½	102⅛	105	1.62½	1.75
November	109¼	114½	101¼	105⅜	104	110	102	106	101¾	109	104⅛	108⅜	1.65	1.72½
December	107⅜	115	101¼	106⅜	106½	112	102½	107	106	110	106⅛	112½	1.65	1.72½
Year	95¾	115	89	106⅜	102	124	89¾	107	89	110	98¾	125	1.55	1.77½
1909.														
January	106½	111¼	103¾	108¾	107	111½	104¾	108¼	107	115	107⅜	111¼	1.70	1.75
February	110⅞	126⅜	108¾	128	110½	121	108¼	125	114	130	110	116¼	1.72½	1.95
March	121⅛	128¾	122½	128½	113⅜	121½	120	130	126	138	112⅝	117⅞	1.85	2.05
April	127½	141	130	145	119	131¼	130	141	135	152½	118⅜	129¼	1.97½	2.15
May	140½	146½	145	150¾	126½	137	141	155	148	160	127⅛	135¼	2.10	2.15
June	146½	150½	152	160	129	136	143	157	128	166	128¾	138⅛	2.10	2.15
July	114½	123⅝	112	122	126½	140	107	140	105½	146	123	135	2.05	2.15
August	108	119⅛	99½	112	104½	136	105½	109	102	111	97⅝	144½	1.75	2.00
September	107⅞	114½	100	113	104	107	107	108	105	122	97¼	101⅞	1.65	1.80
October	......	......	113⅞	119¾	103	109¾	117½	127	116	129	99¼	106⅝	1.65	2.00
November	120	126	114	118	103¼	112	117¾	122½	114	127	101⅛	107¾	1.80	1.90
December	123	127½	116½	122	106	119¾	119½	126	116	132	105½	115⅛	1.95	2.00
Year	106½	150½	99½	160	103	140	104¾	157	102	166	97¼	144½	1.65	2.15
1910.														
January	127	131	123½	128	110½	116⅞	124	121	123	135	110⅝	116⅛	1.90	2.05
February	128	130	124	127¾	111⅜	119	123	126	124	130	110¼	116¾	1.87½	2.00
March	124½	129½	118½	125	113	118¾	116½	123	119½	127½	112	116¾	1.75	1.95
April	112¼	123½	105¼	119½	108½	118¾	106	118	105	122	106½	116½	1.55	1.80
May	106½	117	104¼	109⅝	100	119¼	103	114	100	123	103	114½	1.50	1.58¾
June	104	109	94	101	100	114	104½	107	92	116	102½	117	1.40	1.50
July	107	118	92½	104	111	129½	103	110	102	114½	113	129¼	1.42½	1.70
August	106½	112⅛	97¼	106	117	125½	99½	102½	99	108	109⅜	123	1.60	1.70
September	101	108	99	104½	111	117	97	102½	97	105	109	115	1.50	1.65
October	95⅜	104	90½	98¾	103	114	93½	99	95	104	102	112½	1.42½	1.55
November	94¼	98¼	88¼	95½	101	109	91	96½	92½	99	99½	107	1.40	1.50
December	96	99½	95¼	97	104	110	94½	96¼	94	103	100⅝	106	1.45	1.52½
Year	94¼	131	88¼	128	100	129½	91	127	92	135	99½	129¼	1.40	2.05
1911.														
January	97½	101	94¼	99	103	112	94¾	99	96½	108	101¾	110¼	1.47½	1.55
February	91¾	98⅜	90¾	95¼	97	107	89¾	95¼	91	104½	95¼	104⅞	1.45	1.52½
March	91¾	96⅛	89¾	92¼	95	102	84¾	90½	85½	97	92⅝	100¾	1.40	1.52½
April	90⅛	95¼	89¼	93	93	104	83¼	89½	85	95	91½	101	1.47½	1.52½
May	95	98	92	96¼	98	106	89¾	93	90	98	96	102⅝	1.40	1.50
June	93¼	99	90	93	94	103	87	93¼	85½	92½	93	100⅝	1.40	1.52½
July	90½	95½	87	91½	93½	108½	84½	88½	91¼	96½	95	102⅝	1.42½	1.52½
August	94½	97½	90	93	96	115	86¾	90¾	85¼	91	101	109⅛	1.35	1.47½
September	96⅝	101⅛	90¾	95¼	100	112	88¾	91¾	88	100	102⅛	111¾	1.42½	1.47½
October	98½	105½	93½	100¼	108	117	91	100¾	98	103½	105⅝	112⅜	1.47½	1.50
November	96¾	100	91½	95½	107	112	96¾	97¾	93	99	101	106⅜	1.47½	1.52½
December	94⅞	98⅝	91¼	94¾	105	110	93	97¼	94	100	98½	106¾	1.45	1.52½
Year	90⅛	105½	87	100¼	93	117	83¼	100¾	85	108	91½	112⅜	1.35	1.55

[1] No grade, 1898 to 1901.

[2] No. 2 northern, 1898 to 1900.

WHEAT—Continued.

Average farm price of wheat per bushel, on the first of each month, 1910–1911.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States east of Miss. R.		N. Cen. States west of Miss. R.		South Central States.		Far Western States.	
	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	88.6	103.4	91.5	113.1	101.1	120.9	89.6	112.8	87.3	98.5	95.0	112.2	79.8	100.0
February	89.8	105.0	91.6	115.8	102.8	121.9	91.0	114.8	89.1	100.4	96.6	112.5	79.2	100.2
March	85.4	105.1	89.6	117.6	100.5	122.8	85.8	114.0	83.6	100.1	92.7	113.8	77.2	101.2
April	83.8	104.5	88.0	117.2	97.5	121.2	83.5	110.7	82.0	100.3	92.7	113.3	76.0	101.1
May	84.6	99.9	87.4	110.4	97.8	115.3	83.3	103.4	83.7	97.1	91.2	109.3	77.8	94.4
June	86.3	97.6	90.0	105.6	98.9	113.3	85.5	101.1	84.2	94.5	93.5	107.5	81.5	94.0
July	84.3	95.3	88.0	102.9	95.3	108.8	82.3	97.0	82.9	94.4	87.0	97.1	82.8	88.9
August	82.7	98.9	86.0	102.3	93.4	106.6	78.6	98.2	82.1	100.5	84.7	100.0	82.2	90.1
September	84.8	95.8	86.5	100.6	96.0	106.1	82.3	95.1	86.1	95.6	89.5	96.4	74.9	91.9
October	88.4	93.7	88.8	99.1	98.1	105.7	87.1	92.8	90.7	94.2	91.6	96.1	76.0	86.0
November	91.5	90.5	91.6	97.0	100.7	104.3	91.8	90.4	94.3	89.4	95.9	94.5	75.5	86.0
December	87.4	89.4	93.1	93.4	97.7	102.9	89.4	88.4	89.5	88.2	94.7	93.4	74.5	83.6

International trade in wheat, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	82,599,397	98,502,584	133,610,896	92,377,517	69,209,449
Australia	Jan. 1	30,262,335	28,784,130	15,027,388	31,549,498	47,761,895
Austria-Hungary	Jan. 1	1,118,588	683,014	14,720	10,872	28,476
Belgium	Jan. 1	16,051,913	17,852,194	24,178,475	22,844,944	22,897,924
British India	Jan. 1	26,488,483	37,515,771	4,289,344	34,712,087	40,480,707
Bulgaria	Jan. 1	9,856,687	8,845,502	7,818,338	5,912,621	[2] 8,688,073
Canada	Jan. 1	38,135,023	37,503,057	52,502,903	49,428,195	46,425,872
Chile	Jan. 1	8,065	1,297,765	4,946,857	4,015,335	2,246,921
Germany [3]	Jan. 1	7,365,175	3,520,763	9,594,177	7,708,178	10,339,162
Netherlands	Jan. 1	33,126,858	44,717,615	29,914,096	47,469,644	58,300,147
Roumania	Jan. 1	63,485,127	42,307,592	26,247,406	31,514,810	[4] 31,514,810
Russia	Jan. 1	132,410,638	85,270,647	54,050,456	189,272,459	[2] 225,440,173
Servia	Jan. 1	3,365,644	1,992,514	3,319,526	5,296,155	[4] 5,296,155
United States	Jan. 1	62,850,984	91,383,648	92,779,509	48,489,674	24,257,392
Other countries		6,038,597	10,600,009	6,042,808	11,267,187	[2] 11,723,744
Total		513,163,514	510,776,805	464,336,899	581,869,176	604,610,900

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Austria-Hungary	Jan. 1	1,216,790	87,535	290,334	26,976,334	10,445,042
Belgium	Jan. 1	67,928,168	67,469,371	67,032,575	70,921,646	75,219,303
Brazil	Jan. 1	8,511,259	9,070,298	9,551,436	9,527,692	[4] 9,527,692
Denmark	Jan. 1	4,168,334	2,820,299	3,593,773	3,496,826	2,823,854
France	Jan. 1	11,288,433	13,131,250	2,752,415	5,248,539	23,324,084
Germany [3]	Jan. 1	73,784,363	90,200,107	76,814,333	89,400,124	86,116,905
Greece	Jan. 1	7,426,048	7,454,387	6,638,757	6,490,139	7,659,686
Italy	Jan. 1	50,473,571	34,281,799	29,026,788	48,955,825	45,259,960
Japan	Jan. 1	789,540	2,008,998	1,319,524	778,524	1,818,229
Netherlands	Jan. 1	44,506,710	53,704,405	40,159,483	59,724,417	71,027,060
Portugal	Jan. 1	3,853,239	962,467	4,604,041	3,898,434	3,024,080
Spain	Jan. 1	19,312,985	4,290,674	2,902,239	3,529,873	5,932,747
Sweden	Jan. 1	7,838,974	5,656,901	7,599,881	7,070,799	6,810,148
Switzerland	Jan. 1	16,196,009	17,211,359	12,140,012	14,699,277	14,661,145
United Kingdom	Jan. 1	172,808,565	180,443,017	168,629,046	182,219,770	195,965,190
Other countries		20,373,515	17,537,946	13,722,243	15,000,129	[2] 14,066,062
Total		510,476,503	506,330,813	446,776,880	547,938,348	573,681,187

[1] See "General note," p. 526.
[2] Preliminary.
[3] Not including free ports prior to March 1, 1906.
[4] Year preceding.

WHEAT—Continued.

International trade in wheat flour, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
Argentina	Jan. 1	1,450,979	1,434,118	1,276,656	1,310,241	1,298,104
Australia	Jan. 1	1,702,801	1,667,722	1,191,861	1,326,216	1,428,019
Austria-Hungary	Jan. 1	658,449	658,555	413,076	163,111	145,777
Belgium	Jan. 1	439,659	442,303	529,660	583,822	718,100
British India	Jan. 1	417,984	476,995	350,407	365,851	448,576
Bulgaria	Jan. 1	261,974	293,509	287,042	348,572	[2] 581,360
Canada	Jan. 1	1,516,170	1,858,483	1,747,163	2,541,849	3,189,208
Chile	Jan. 1	50,008	42,207	25,446	72,073	128,593
France	Jan. 1	344,996	299,247	365,496	493,116	283,272
Germany[3]	Jan. 1	663,437	987,604	1,702,862	1,855,560	2,137,285
Italy	Jan. 1	355,934	510,538	499,259	472,266	660,894
Netherlands	Jan. 1	110,985	159,970	145,451	292,223	267,489
Roumania	Jan. 1	745,296	556,898	172,470	212,673	[4] 212,673
Russia	Jan. 1	1,131,591	744,832	597,477	1,062,040	[2] 1,139,764
Servia	Jan. 1	86,885	33,570	62,998	53,027	[4] 53,027
United Kingdom	Jan. 1	599,560	692,366	988,326	780,172	722,449
United States	Jan. 1	14,324,100	15,276,506	13,013,025	9,687,993	8,370,201
Other countries		282,193	560,528	802,922	1,745,518	[2] 1,971,464
Total		25,143,001	26,695,951	24,171,597	23,366,323	23,756,255

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Belgium	Jan. 1	55,601	48,735	31,735	23,211	29,365
Brazil	Jan. 1	1,731,596	1,915,018	1,699,315	1,645,630	[4] 1,645,630
China	Jan. 1	1,214,069	3,002,982	1,194,514	405,971	503,973
Cuba	Jan. 1	735,950	861,865	780,514	807,220	852,876
Denmark	Jan. 1	328,972	384,268	441,515	515,921	549,230
Egypt	Jan. 1	1,684,257	1,582,387	1,919,766	1,916,444	1,367,797
Finland	Jan. 1	879,955	963,974	1,022,029	964,691	999,454
France	Jan. 1	98,572	197,245	81,824	49,118	140,729
Germany[3]	Jan. 1	242,116	221,301	190,882	141,292	166,857
Greece	Jan. 1	110,867	60,923	24,953	12,711	9,379
Italy	Jan. 1	15,043	18,605	18,021	11,864	13,826
Japan	Jan. 1	1,082,671	838,641	352,537	172,165	203,337
Netherlands	Jan. 1	2,260,321	1,908,957	2,200,426	2,085,637	2,204,100
Newfoundland	July 1	411,781	366,237	340,876	410,526	[4] 410,526
Norway	Jan. 1	472,995	564,617	632,712	548,686	547,309
Philippine Islands	Jan. 1	231,301	266,644	231,305	296,560	349,929
Spain	Jan. 1	161,765	695	172	630	867
Sweden	Jan. 1	83,949	125,421	120,137	70,646	88,870
Trinidad and Tobago	Apr. 1	227,838	226,291	230,994	220,039	222,378
United Kingdom	Jan. 1	8,024,846	7,565,526	7,358,072	6,282,145	5,614,907
Other countries		4,056,874	4,415,503	5,293,688	4,950,415	[2] 4,652,378
Total		24,111,339	25,535,835	24,165,987	21,531,522	20,573,717

[1] See "General note," p. 526.
[2] Preliminary.
[3] Not including free ports prior to Mar. 1, 1906.
[4] Year preceding.

WHEAT—Continued.

International trade in wheat, including wheat flour, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	89,128,803	104,956,115	139,355,848	98,273,601	75,050,917
Australia	Jan. 1	37,924,939	36,288,879	20,390,762	37,517,470	54,187,981
Austria-Hungary	Jan. 1	4,081,608	3,646,512	1,873,562	744,872	684,472
Belgium	Jan. 1	18,030,379	19,842,558	26,561,945	25,472,143	26,129,374
British India	Jan. 1	28,369,411	39,662,249	5,866,175	36,358,417	42,499,299
Bulgaria	Jan. 1	11,035,570	10,166,292	9,110,027	7,481,195	[2] 11,304,193
Canada	Jan. 1	44,957,788	45,866,231	60,365,137	60,866,515	60,777,308
Chile	Jan. 1	233,101	1,487,697	5,061,364	4,339,663	2,825,589
France	Jan. 1	1,639,164	1,394,463	1,863,508	2,896,235	1,324,214
Germany[3]	Jan. 1	10,350,641	7,964,981	17,257,056	16,058,198	19,956,944
Italy	Jan. 1	1,616,547	2,369,916	2,271,395	2,141,070	2,998,861
Netherlands	Jan. 1	33,626,290	45,437,480	30,568,626	48,784,648	59,503,847
Roumania	Jan. 1	66,838,959	44,813,633	27,023,521	32,471,838	[4] 32,471,838
Russia	Jan. 1	137,502,798	88,622,391	56,739,102	194,051,639	[2] 230,569,111
Servia	Jan. 1	3,756,626	2,143,579	3,603,017	5,534,777	[4] 5,534,777
United Kingdom	Jan. 1	2,792,173	3,600,114	5,026,976	3,950,066	4,448,078
United States	Jan. 1	127,309,434	160,127,925	151,338,121	92,085,642	61,923,296
Other countries	....	7,112,787	12,517,571	8,832,943	17,989,641	[2] 19,323,949
Total	....	626,307,018	630,908,586	573,109,085	687,017,630	711,514,048

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Austria-Hungary	Jan. 1	1,255,868	130,321	332,931	27,162,972	10,616,726
Belgium	Jan. 1	68,178,372	67,688,679	67,175,383	71,026,096	75,351,445
Brazil	Jan. 1	16,303,441	17,687,879	17,198,354	16,933,027	[4] 16,933,027
China	Jan. 1	5,463,370	13,513,419	5,375,313	1,826,870	2,267,878
Cuba	Jan. 1	3,311,775	3,878,392	3,512,313	3,632,490	3,837,942
Denmark	Jan. 1	5,648,708	4,549,505	5,580,591	5,818,470	5,295,389
Egypt	Jan. 1	8,293,376	7,701,728	9,280,247	8,797,443	6,188,823
Finland	Jan. 1	3,966,878	4,397,732	4,612,775	4,348,581	4,506,891
France	Jan. 1	11,732,007	14,018,852	3,120,623	5,469,570	23,957,364
Germany[3]	Jan. 1	74,873,885	91,195,961	77,673,302	90,035,938	86,867,761
Greece	Jan. 1	7,924,950	7,728,541	6,751,045	6,547,339	7,701,892
Italy	Jan. 1	50,541,265	34,365,521	29,107,883	49,009,213	45,322,177
Japan	Jan. 1	5,661,560	5,782,882	2,905,941	1,553,266	2,733,245
Netherlands	Jan. 1	54,678,154	62,294,711	50,061,400	69,109,783	80,945,510
Newfoundland	Jan. 1	1,853,014	1,648,066	1,533,942	1,847,367	[4] 1,847,367
Norway	Jan. 1	2,894,356	3,092,015	3,675,974	3,273,259	3,284,945
Philippine Islands	Jan. 1	1,040,854	1,199,898	1,040,872	1,334,520	1,574,680
Portugal	Jan. 1	3,853,239	962,467	4,604,041	3,898,434	3,024,080
Spain	Jan. 1	20,040,927	4,293,802	2,903,013	3,532,708	5,936,649
Sweden	Jan. 1	8,216,744	6,221,295	8,140,497	7,388,706	7,210,063
Switzerland	Jan. 1	16,196,009	17,211,359	12,140,012	14,699,277	14,661,145
Trinidad and Tobago	Apr. 1	1,025,271	1,018,310	1,039,473	990,176	1,000,701
United Kingdom	Jan. 1	208,920,372	214,487,884	201,740,370	210,489,422	221,232,272
Other countries	....	37,103,134	36,172,850	36,017,527	36,105,270	[2] 33,964,941
Total	....	618,977,529	621,242,069	555,523,822	644,830,197	666,262,913

[1] "General note," p. 526.
[2] Preliminary.
[3] Not including free ports prior to March 1, 1906.
[4] Year preceding.

WHEAT—Continued.

Wholesale prices of flour per barrel, by months, 1907–1911.

Date.	Chicago.		Cincinnati.		New York.		St. Louis.		Chicago.	
	Winter patents.		Winter family.		Winter patents.		Winter patents.		Spring patents.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1907.										
January	$3.20	$3.50	$2.70	$3.00	$3.60	$3.85	$3.50	$3.75	$2.70	$3.80
February	3.20	3.50	2.70	3.00	3.60	3.90	3.55	3.80	3.50	3.80
March	3.10	3.50	2.70	3.00	3.60	3.90	3.60	3.80	3.40	3.60
April	3.10	3.40	2.70	3.05	3.60	4.00	3.60	3.90	3.40	3.50
May	3.25	4.30	2.90	3.70	3.80	5.00	3.80	4.80	3.55	5.40
June	3.70	4.35	3.50	3.70	4.70	5.10	4.35	5.00	4.50	5.30
July	4.10	4.40	3.50	3.70	4.60	5.10	4.25	4.60	4.50	5.00
August	3.90	4.40	3.40	3.70	4.50	4.80	4.00	4.40	4.70	5.10
September	4.20	4.50	3.50	4.00	4.60	5.10	4.30	4.80	5.00	5.50
October	4.20	5.10	4.00	4.30	4.85	5.40	4.50	5.00	5.10	5.75
November	4.25	4.80	3.90	4.10	4.80	5.25	4.65	5.00	5.10	5.60
December	4.30	4.80	3.90	4.00	4.75	5.25	4.60	4.90	5.20	5.70
1908.										
January	4.50	4.90	3.90	4.00	4.75	5.15	4.65	4.90	5.30	5.75
February	4.30	4.65	3.70	3.90	4.50	5.00	4.40	4.85	5.05	5.35
March	4.30	4.90	3.90	4.00	4.65	5.05	4.60	4.85	5.25	5.60
April	4.20	4.80	3.60	3.90	4.60	5.00	4.50	4.80	4.90	5.25
May	4.20	4.95	3.70	3.95	4.60	4.90	4.55	4.90	5.10	5.70
June	4.20	4.85	3.25	3.95	4.35	4.90	4.40	4.85	5.10	5.45
July	4.15	4.70	3.25	3.55	4.30	4.70	4.40	4.65	5.10	5.65
August	4.00	4.60	3.25	3.75	4.30	4.65	4.35	4.85	5.50	5.70
September	4.05	4.75	3.45	3.95	4.25	4.85	4.40	4.90	5.10	5.75
October	4.35	4.85	3.70	4.00	4.35	4.90	4.60	4.90	5.20	5.50
November	4.40	4.85	3.75	4.10	4.40	5.10	4.65	5.10	5.15	5.40
December	4.50	5.10	3.85	4.10	4.60	5.20	4.80	5.10	5.25	5.60
1909.										
January	4.75	5.20	3.95	4.15	4.60	5.10	4.80	5.25	5.35	5.55
February	4.75	5.60	4.00	4.50	4.70	5.80	5.10	6.25	5.50	5.90
March	5.30	5.75	4.50	4.95	5.35	5.95	5.80	6.40	5.40	6.00
April	5.35	6.70	4.85	5.35	5.35	6.40	6.10	7.00	5.40	6.25
May	6.30	6.60	5.15	5.75	6.10	6.85	6.25	7.00	5.80	6.40
June	6.30	6.75	5.55	5.85	6.40	7.10	6.50	7.00	6.00	7.00
July	6.00	6.60	4.80	5.75	5.90	6.75	4.80	6.50	6.00	6.40
August	4.70	5.40	4.25	5.60	5.10	6.00	4.60	5.25	5.60	6.10
September	4.65	5.10	4.25	4.70	4.85	5.30	4.90	5.50	5.80	6.40
October	4.65	5.90	4.35	4.80	5.00	5.85	5.40	6.10	5.90	6.15
November	5.00	5.80	4.50	4.80	5.10	5.80	5.50	5.85	6.00	6.35
December	5.10	5.70	4.50	5.00	5.10	5.75	5.55	6.10	6.25	6.60
1910.										
January	5.20	5.80	4.75	5.10	5.25	5.80	5.60	6.20	6.20	6.60
February	5.15	5.70	4.85	5.10	5.35	5.90	5.60	6.00	6.20	6.50
March	5.30	5.70	4.40	5.10	5.50	5.90	5.50	6.00	6.40	6.55
April	5.00	5.55	4.20	4.75	5.00	5.75	5.00	5.80	6.00	6.55
May	4.80	5.25	3.90	4.55	4.40	5.30	5.00	5.45	6.10	6.45
June	4.50	5.10	3.70	4.00	4.25	4.85	4.90	5.35	6.00	6.55
July	4.60	5.50	3.25	3.70	4.40	5.25	4.90	5.50	6.55	7.00
August	4.45	5.30	3.25	3.50	4.50	5.10	4.70	5.00	6.40	6.80
September	4.35	5.15	3.15	3.50	4.50	4.85	4.55	5.00	6.30	6.50
October	4.10	4.95	3.10	3.40	4.25	4.75	4.40	4.90	6.20	6.40
November	4.10	4.80	3.10	3.30	4.10	4.70	4.35	4.80	6.00	6.35
December	4.00	4.75	3.10	3.30	4.15	4.70	4.40	4.75	6.20	6.35
1911.										
January	4.20	4.80	3.10	3.40	4.50	4.65	4.50	5.25	6.30	6.55
February	4.00	4.70	3.15	3.50	4.25	4.45	4.35	5.00	5.60	6.40
March	3.75	4.35	3.10	3.40	4.20	4.25	4.25	4.75	5.30	5.70
April	3.75	4.30	3.10	3.35	4.10	4.25	4.10	4.75	5.25	5.50
May	3.80	4.50	3.00	3.25	4.35	4.35	4.15	4.60	5.40	5.90
June	3.80	4.50	2.80	3.25	4.25	4.35	4.10	4.60	5.10	5.75
July	3.60	4.40	2.60	3.10	4.25	4.35	3.90	4.50	5.40	5.70
August	3.60	4.50	2.60	2.85	4.35	4.60	4.10	4.40	5.50	6.10
September	3.90	4.80	2.70	3.60	4.50	4.55	4.10	4.65	5.70	6.00
October	4.15	5.40	3.30	3.70	4.55	4.80	4.50	4.90	6.00	6.25
November	4.00	5.30	3.40	3.70	4.60	4.75	4.50	4.90	5.75	6.15
December	3.75	5.05	3.40	3.65	4.50	4.55	4.40	4.80	5.70	6.00

OATS.

Oat area of countries named, 1907–1911.

Country.	1907	1908	1909	1910	1911
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	31,837,000	32,344,000	35,159,200	37,548,000	37,763,000
Canada:					
New Brunswick	194,200	203,900	207,200	213,900	198,500
Ontario	2,932,500	3,108,400	3,142,200	3,272,000	2,734,100
Manitoba	1,213,600	1,322,800	1,390,000	1,451,000	1,260,700
Saskatchewan	801,800	930,100	1,847,000	1,973,000	2,124,100
Alberta	307,100	549,400	820,000	974,000	1,178,400
Other	1,786,900	1,826,500	1,896,200	1,980,200	1,724,100
Total Canada	7,236,100	7,941,100	9,302,600	9,864,100	9,219,900
Mexico	(1)	(1)	(1)	(1)	(1)
SOUTH AMERICA.					
Argentina	362,000	702,000	1,564,900	1,414,900	1,980,200
Uruguay	4,900	8,700	17,000	(1)	29,000
EUROPE.					
Austria-Hungary:					
Austria	4,783,200	4,495,600	4,574,400	4,529,400	4,640,700
Hungary proper	2,653,100	2,612,500	2,695,200	2,640,500	2,653,300
Croatia-Slavonia	248,700	246,800	246,900	243,400	246,900
Bosnia-Herzegovina	215,500	220,700	207,100	185,300	229,300
Total Austria-Hungary	7,900,500	7,575,600	7,723,600	7,598,600	7,770,200
Belgium	613,900	630,100	618,300	(1)	(1)
Bulgaria	468,900	562,700	485,700	488,900	(1)
Denmark	996,000	(1)	(1)	(1)	(1)
Finland	(1)	(1)	(1)	(1)	(1)
France	9,565,300	9,628,800	9,702,500	9,763,700	9,930,300
Germany	10,816,000	10,564,400	10,650,100	10,599,100	10,693,700
Italy	(1)	(1)	(1)	1,243,700	1,270,500
Netherlands	344,200	345,500	349,700	348,400	326,100
Norway	264,300	(1)	(1)	(1)	(1)
Roumania	871,000	1,211,600	1,197,200	1,103,900	991,900
Russia:					
Russia proper	37,964,500	37,697,900	37,603,600	....	....
Poland	2,829,100	2,794,900	2,813,900	....	....
Northern Caucasia	981,500	1,107,100	1,122,400	....	....
Total Russia (European)	41,775,100	41,599,900	41,539,900	42,922,900	(1)
Servia	237,500	249,500	252,000	221,000	....
Spain	1,186,500	1,210,600	1,227,200	1,255,800	1,268,400
Sweden	2,002,800	1,998,300	1,994,100	1,970,600	(1)
United Kingdom:					
Great Britain—					
England	1,967,700	1,958,700	1,839,900	1,857,700	1,841,100
Scotland	951,000	948,500	943,400	958,200	963,500
Wales	203,900	201,600	198,500	205,100	206,000
Ireland	1,075,400	1,060,300	1,035,800	1,073,700	1,040,200
Total United Kingdom	4,198,000	4,169,100	4,017,600	4,094,700	4,050,800
ASIA.					
Cyprus	(1)	(1)	(1)	(1)	(1)
Russia:					
Central Asia	615,900	715,900	976,400	....	....
Siberia	3,113,500	3,343,500	3,751,200	....	....
Transcaucasia	1,300	1,200	1,400	....	....
Total Russia (Asiatic)	3,730,700	4,060,600	4,729,000	4,427,000	(1)
AFRICA.					
Algeria	340,700	425,200	361,400	404,500	434,100
Tunis	91,400	93,900	148,300	153,200	(1)
Union of South Africa	(1)	(1)	(1)	(1)	(1)
AUSTRALASIA.					
Australia:					
Queensland	1,200	700	1,800	2,800	2,500
New South Wales	56,500	75,800	59,900	81,500	78,000
Victoria	380,500	398,700	419,900	384,200	392,700
South Australia	57,000	66,300	78,500	85,300	77,700
Western Australia	28,400	46,700	59,400	73,300	61,900
Tasmania	58,300	54,600	56,700	71,300	63,900
Total Australia	581,900	642,800	676,200	698,400	676,700
New Zealand	372,900	386,900	406,900	377,000	302,000
Total Australasia	954,800	1,029,700	1,083,100	1,075,400	978,700

[1] No official statistics of area.

OATS—Continued.

Oat crop of countries named, 1907–1911.

Country.	1907	1908	1909	1910	1911
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	754,443,000	807,156,000	1,007,129,000	1,186,341,000	922,298,000
Canada:					
New Brunswick	6,107,000	5,373,000	6,136,000	6,748,000	6,085,000
Ontario	88,745,000	110,310,000	116,017,000	136,974,000	87,846,000
Manitoba	44,775,000	47,506,000	58,721,000	44,351,000	61,511,000
Saskatchewan	24,783,000	31,030,000	97,533,000	65,203,000	104,085,000
Alberta	9,826,000	24,227,000	40,775,000	25,122,000	60,524,000
Other	54,981,000	47,580,000	56,376,000	65,267,000	49,898,000
Total Canada	229,217,000	266,026,000	375,558,000	343,665,000	369,949,000
Mexico	17,000	17,000	17,000	17,000	17,000
Total	983,677,000	1,073,199,000	1,382,704,000	1,530,023,000	1,292,264,000
SOUTH AMERICA.					
Argentina	12,257,000	33,949,000	31,984,000	36,483,000	47,192,000
Uruguay	121,000	239,000	462,000	400,000	590,000
Total	12,378,000	34,188,000	32,446,000	36,883,000	47,782,000
EUROPE.					
Austria-Hungary:					
Austria	170,605,000	144,069,000	171,940,000	142,139,000	156,384,000
Hungary proper	79,484,000	70,168,000	92,270,000	70,701,000	90,151,000
Croatia-Slavonia	4,174,000	4,253,000	5,607,000	5,445,000	5,554,000
Bosnia-Herzegovina	2,575,000	3,572,000	4,575,000	5,322,000	5,405,000
Total Austria-Hungary	256,838,000	222,062,000	274,392,000	223,607,000	257,494,000
Belgium	45,937,000	43,058,000	43,231,000	35,000,000	40,000,000
Bulgaria	7,416,000	11,252,000	9,356,000	10,789,000	11,000,000
Denmark	42,529,000	40,437,000	42,170,000	40,596,000	49,830,000
Finland	20,643,000	18,321,000	19,759,000	18,000,000	18,000,000
France	303,889,000	285,837,000	331,183,000	290,776,000	305,370,000
Germany	630,324,000	530,131,000	628,718,000	544,287,000	530,764,000
Italy	30,000,000	30,000,000	43,402,000	28,574,000	40,973,000
Netherlands	20,933,000	19,683,000	19,361,000	20,357,000	18,515,000
Norway	6,946,000	11,315,000	8,804,000	10,488,000	8,593,000
Roumania	17,842,000	17,212,000	25,945,000	29,647,000	26,222,000
Russia:					
Russia proper	729,813,000	743,523,000	960,498,000		
Poland	72,574,000	66,135,000	73,758,000		
Northern Caucasia	19,697,000	24,860,000	33,428,000		
Total Russia (European)	822,084,000	834,518,000	1,067,684,000	966,248,000	792,902,000
Servia	2,984,000	3,057,000	3,445,000	2,205,000	2,590,000
Spain	16,998,000	28,114,000	34,307,000	29,018,000	33,858,000
Sweden	64,597,000	72,773,000	69,292,000	75,238,000	63,462,000
United Kingdom:					
Great Britain—					
England	94,606,000	82,470,000	80,573,000	80,225,000	74,119,000
Scotland	36,193,000	37,920,000	39,097,000	37,425,000	36,750,000
Wales	7,829,000	7,133,000	7,233,000	8,018,000	7,087,000
Ireland	50,850,000	54,032,000	57,467,000	65,770,000	59,207,000
Total United Kingdom	189,478,000	181,555,000	184,370,000	191,438,000	177,163,000
Total	2,479,438,000	2,349,325,000	2,805,419,000	2,516,268,000	2,376,736,000
ASIA.					
Cyprus	331,000	382,000	385,000	525,000	480,000
Russia:					
Central Asia	18,049,000	17,371,000	15,633,000		
Siberia	67,114,000	89,500,000	62,033,000		
Transcaucasia	13,000	27,000	37,000		
Total Russia (Asiatic)	85,176,000	106,898,000	77,703,000	79,743,000	65,454,000
Total	85,507,000	107,280,000	78,088,000	80,268,000	65,934,000

OATS—Continued.

Oat crop of countries named, 1907-1911—Continued.

Country.	1907	1908	1909	1910	1911
AFRICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Algeria	10,651,000	9,600,000	10,673,000	13,258,000	11,520,000
Tunis	3,149,000	1,736,000	5,443,000	5,374,000	5,000,000
Union of South Africa	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
Total	17,300,000	14,836,000	19,616,000	22,132,000	20,020,000
AUSTRALASIA.					
Australia:					
Queensland	30,000	10,000	40,000	52,000	52,000
New South Wales	1,449,000	879,000	1,154,000	2,029,000	1,756,000
Victoria	9,124,000	5,365,000	11,475,000	8,163,000	10,005,000
South Australia	924,000	902,000	1,320,000	1,247,000	1,172,000
Western Australia	472,000	745,000	765,000	1,287,000	801,000
Tasmania	2,042,000	1,574,000	1,900,000	2,422,000	2,128,000
Total Australia	14,041,000	9,475,000	16,654,000	15,200,000	15,914,000
New Zealand	11,555,000	15,495,000	19,503,000	13,953,000	10,412,000
Total Australasia	25,596,000	24,970,000	36,157,000	29,153,000	26,326,000
Grand total	3,603,896,000	3,603,798,000	4,354,430,000	4,214,727,000	3,829,062,000

Average yield of oats in countries named, bushels per acre, 1890–1911.

Year.	United States.	Russia, European.[1]	Germany.[1]	Austria.[1]	Hungary proper.[1]	France.[2]	United Kingdom.[2]
Average (1890-1899)	26.1	17.8	40.0	25.3	....	29.8	43.6
Average (1900-1909)	29.3	20.0	50.7	29.8	30.7	31.6	44.3
1902	34.5	21.8	50.1	27.7	33.2	29.2	48.3
1903	28.4	17.7	51.2	28.3	34.5	31.6	44.2
1904	32.1	25.7	46.2	24.3	25.6	27.2	44.2
1905	34.0	20.2	43.6	27.7	31.0	28.6	41.7
1906	31.2	15.1	55.7	34.1	34.2	27.0	43.8
1907	23.7	19.7	58.3	35.7	30.0	31.8	45.1
1908	25.0	20.1	50.2	32.0	26.8	29.6	43.5
1909	28.6	25.7	59.0	37.6	33.8	34.1	45.9
1910	31.6	18.1	51.4	31.4	26.8	29.8	46.8
1911	24.4	....	49.6	23.7	34.0	30.5	43.7
Average (1902-1911)	29.4	....	51.5	31.2	31.0	30.0	44.7

[1] Bushels of 32 pounds. [2] Winchester bushels.

Condition of the oat crop in the United States on the first of months named, 1891–1911.

Year.	June.	July.	August.	When harvested.	Year.	June.	July.	August.	When harvested.	Year.	June.	July.	August.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1891	85.1	87.6	89.5	90.7	1898	98.0	92.8	84.2	79.0	1905	92.9	92.1	90.8	90.3
1892	88.5	87.2	86.2	78.9	1899	88.7	90.0	90.8	87.2	1906	85.9	84.0	82.8	81.9
1893	88.9	88.8	78.3	74.9	1900	91.7	85.5	85.0	82.9	1907	81.6	81.0	75.6	65.5
1894	87.0	77.7	76.5	77.8	1901	85.3	83.7	73.6	72.1	1908	92.9	85.7	76.8	69.7
1895	84.3	83.2	84.5	86.0	1902	90.6	92.1	89.4	87.2	1909	88.7	88.3	85.5	83.8
1896	98.8	96.3	77.3	74.0	1903	85.5	84.3	79.5	75.7	1910	91.0	82.2	81.5	83.3
1897	89.0	87.5	86.0	84.6	1904	89.2	89.8	86.6	85.6	1911	85.7	68.8	65.7	64.5

OATS—Continued.

Acreage production, value, prices, exports, etc., of oats in the United States, 1849–1911.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	Chicago cash price per bushel, No. 2. December. High.	Chicago cash price per bushel, No. 2. May of following year. Low.	Chicago cash price per bushel, No. 2. May of following year. High.	Domestic exports, including oatmeal, fiscal year beginning July 1.[1]	Imports during fiscal year beginning July 1.[2]
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels.*
1849[3]			*146,584,000*								
1859[3]			*172,643,000*								
1866	8,864,000	30.2	268,141,000	35.1	94,058,000	36	43	59	78	825,895	778,198
1867	10,746,000	25.9	278,698,000	44.5	123,903,000	52	57¼			122,554	780,798
1868	9,666,000	26.4	254,961,000	41.7	106,356,000	43	49½	56¾	62½	481,871	326,659
1869	9,461,000	30.5	288,334,000	38.0	109,522,000	40	44¾	46½	53½	121,517	2,266,785
1869[3]			*282,107,000*								
1870	8,792,000	28.1	247,277,000	39.0	96,444,000	37¾	41	47¼	51	147,572	599,514
1871	8,366,000	30.6	255,743,000	36.2	92,591,000	30¾	33	34¾	42½	262,975	535,250
1872	9,001,000	30.2	271,747,000	29.9	81,304,000	23½	25¾	30	34	714,072	225,555
1873	9,752,000	27.7	270,340,000	34.6	93,474,000	34	40⅝	44	48½	812,873	191,802
1874	10,897,000	22.1	240,369,000	47.1	113,134,000	51¾	54½	57¼	64½	504,770	1,500,040
1875	11,915,000	29.7	354,318,000	32.0	113,441,000	29½	30½	28⅝	31½	1,466,228	121,547
1876	13,359,000	24.0	320,884,000	32.4	103,845,000	31¾	34½	37¼	45¾	2,854,128	41,597
1877	12,826,000	31.7	406,394,000	28.4	115,546,000	24⅛	27	23	27	3,715,479	21,391
1878	13,176,000	31.4	413,579,000	24.6	101,752,000	19⅝	20⅜	24⅜	30½	5,452,136	13,395
1879	12,684,000	28.7	363,761,000	33.1	120,533,000	32¾	36¾	29½	34⅞	766,366	489,576
1879[3]	*16,145,000*	*25.8*	*407,859,000*								
1880	16,188,000	25.8	417,885,000	36.0	150,244,000	29⅛	33½	36¼	39½	402,904	64,412
1881	16,832,000	24.7	416,481,000	46.4	193,199,000	43½	46¾	48¾	56⅜	625,690	1,850,983
1882	18,495,000	26.4	488,251,000	37.5	182,978,000	34¾	41½	38¾	42¾	461,496	815,017
1883	20,325,000	28.1	571,302,000	32.7	187,040,000	29⅜	36⅛	30¾	34¼	3,274,622	121,069
1884	21,301,000	27.4	583,628,000	27.7	161,528,000	22½	25¼	34½	37	6,203,104	94,310
1885	22,784,000	27.6	629,409,000	28.5	179,632,000	27	29	26¼	29⅝	7,311,306	149,480
1886	23,658,000	26.4	624,134,000	29.8	186,138,000	25¾	27¼	25⅛	27½	1,374,635	139,575
1887	25,921,000	25.4	659,618,000	30.4	200,700,000	28⅝	30⅞	32½	38	573,080	123,817
1888	26,998,000	26.0	701,735,000	27.8	195,424,000	25	26⅞	21⅝	23⅝	1,191,471	131,501
1889	27,462,000	27.4	751,515,000	22.9	171,781,000	20	21	24¾	30	15,107,238	153,232
1889[3]	*28,321,000*	*28.6*	*809,251,000*								
1890	26,431,000	19.8	523,621,000	42.4	222,048,000	39⅞	43⅞	45¼	54	1,382,836	41,848
1891	25,582,000	28.9	738,394,000	31.5	232,312,000	31⅛	33⅝	28⅛	33½	10,586,644	47,782
1892	27,064,000	24.4	661,035,000	31.7	209,254,000	25⅝	31¼	28¾	32¼	2,700,793	49,433
1893	27,273,000	23.4	638,855,000	29.4	187,576,000	27½	29⅛	32½	36	6,290,229	31,759
1894	27,024,000	24.5	662,037,000	32.4	214,817,000	28¾	29⅜	27½	30¾	1,708,824	330,318
1895	27,878,000	29.6	824,444,000	19.9	163,655,000	16⅝	17½	18	19⅜	15,156,618	66,602
1896	27,566,000	25.7	707,346,000	18.7	132,485,000	16½	18¾	16⅞	18¾	37,725,083	131,204
1897	25,730,000	27.2	698,768,000	21.2	147,975,000	21	23⅞	26	32	73,880,307	25,093
1898	25,777,000	28.4	730,907,000	25.5	186,405,000	26	27¾	24	27¾	33,534,362	28,098
1899	26,341,000	30.2	796,178,000	24.9	198,168,000	22¼	23	21¼	23¾	45,048,857	54,576
1899[3]	*29,540,000*	*31.9*	*943,389,000*								
1900	27,365,000	29.6	809,126,000	25.8	208,669,000	21¾	22¾	27⅞	31	42,268,931	32,107
1901	28,541,000	25.8	736,809,000	39.9	293,659,000	42	48¼	41	49½	13,277,612	38,978
1902	28,653,000	34.5	987,843,000	30.7	303,585,000	29¼	32	33⅜	38¼	8,381,805	150,065
1903	27,638,000	28.4	784,094,000	34.1	267,662,000	34¼	38	39⅝	44¾	1,960,740	183,983
1904	27,843,000	32.1	894,596,000	31.3	279,900,000	28¼	32	[4] 28⅝	[4] 32	8,394,692	55,699
1905	28,047,000	34.0	953,216,000	29.1	277,048,000	[4] 29½	[4] 32¾	[4] 32⅛	[4] 34¾	48,434,541	40,025
1906	30,959,000	31.2	964,905,000	31.7	306,293,000	[4] 33	[4] 35¾	[4] 44½	[4] 48½	6,386,334	91,289
1907	31,837,000	23.7	754,443,000	44.3	334,568,000	[4] 46½	[4] 50⅞	[4] 52¾	[4] 56½	2,518,855	383,418
1908	32,344,000	25.0	807,156,000	47.2	381,171,000	[4] 48⅜	[4] 50½	[4] 56¼	[4] 62½	2,333,817	6,691,700
1909	33,204,000	30.3	1,007,353,000	40.5	408,174,000	[4] 40	[4] 45	[4] 36½	[4] 43¼	2,548,726	1,034,511
1909[3]	*35,159,000*	*28.4*	*1,007,129,000*								
1910[5]	37,548,000	31.6	1,186,341,000	34.4	408,388,000	[4] 31	[4] 32½	[4] 31⅞	[4] 36	3,845,850	107,318
1911[5]	*37,763,000*	*24.4*	*922,298,000*	*45.0*	*414,663,000*	[4] *46¼*	[4] *47⅜*				

[1] Oatmeal not included 1866 to 1882, inclusive.
[2] Oatmeal not included 1867 to 1882, inclusive, and 1909.
[3] Census figures.
[4] Quotations are for standard.
[5] Figures adjusted to census basis.

OATS—Continued.

Acreage, production, value, and distribution of oats in the United States, by States, 1911–1909.

[Expressed in thousands; 000 omitted.]

State and Division.	Acreage.			Production.			Farm value, basis Dec. 1 price.			Farm reserves of old crop, Aug. 1—		Shipped.[1]
	1911	1910	1909 (census).	1911	1910	1909 (census).	1911	1910	1909	1911	1910	
	Acres.	*Acres.*	*Acres.*	*Bush.*	*Bush.*	*Bush.*	*Dolls.*	*Dolls.*	*Dolls.*	*Bu.*	*Bu.*	*P. ct.*
Me	135	130	121	5,198	5,512	4,232	2,807	2,646	2,455	302	239	3
N. H	12	11	11	406	471	386	248	240	247	20	12	0
Vt	76	76	72	2,660	3,154	2,141	1,569	1,577	1,071	112	74	1
Mass	8	8	8	280	284	268	162	142	156	3	7	0
R. I	2	2	2	58	70	48	34	34	26	1	1	0
Conn	11	11	10	386	405	274	216	178	145	4	4	0
N. Y	1,310	1,320	1,303	38,645	45,540	34,795	19,709	19,127	17,050	2,958	1,984	5
N. J	71	72	72	2,024	2,671	1,377	1,012	1,175	688	216	70	14
Pa	1,121	1,144	1,144	31,724	40,269	28,173	15,862	16,510	14,086	2,499	1,466	6
N. Atlantic	2,746	2,774	2,743	81,381	98,376	71,694	41,619	41,629	35,924	6,115	3,857	5.3
Del	4	4	4	120	135	98	56	58	47	2	2	9
Md	46	47	49	1,242	1,410	1,161	609	649	569	32	31	12
Va	194	198	204	3,880	4,356	2,884	2,095	2,134	1,558	110	81	8
W. Va	110	110	104	2,420	2,772	1,729	1,355	1,386	934	56	48	2
N. C	219	221	228	3,614	4,022	2,782	2,277	2,413	1,836	60	28	2
S. C	345	336	324	7,038	7,056	5,745	5,067	4,586	4,137	234	142	3
Ga	404	404	412	8,686	7,353	6,199	6,080	4,706	4,401	197	105	4
Fla	43	42	43	580	680	606	435	442	455	8	6	3
S. Atlantic	1,365	1,362	1,368	27,580	27,704	21,204	17,974	16,374	13,937	699	443	4.2
Ohio	1,700	1,770	1,788	54,570	65,844	57,591	24,556	23,045	23,612	3,948	3,110	33
Ind	1,640	1,680	1,668	47,068	59,472	50,608	20,239	18,436	19,737	2,380	2,024	44
Ill	4,220	4,325	4,177	121,536	164,350	150,386	51,045	49,305	57,147	8,215	7,971	54
Mich	1,500	1,515	1,429	42,900	51,510	43,870	19,734	18,028	17,986	2,318	2,678	26
Wis	2,250	2,250	2,164	67,050	67,050	71,336	30,172	22,797	27,821	4,020	6,060	19
N. C. E. Miss. R	11,310	11,540	11,226	333,124	408,226	373,791	145,746	131,611	146,303	20,881	21,843	38.5
Minn	2,948	2,977	2,977	67,214	85,440	93,898	26,886	27,341	32,864	6,234	8,451	20
Iowa	4,950	5,100	4,655	126,225	192,780	128,198	51,752	52,051	44,869	14,267	10,897	42
Mo	1,200	1,200	1,073	17,760	40,320	24,829	7,992	12,902	10,676	2,579	868	17
N. Dak	2,180	2,165	2,147	51,230	15,155	65,887	21,004	5,607	21,743	350	5,799	9
S. Dak	1,540	1,550	1,559	11,396	35,650	43,566	4,900	10,695	14,812	1,638	3,183	20
Nebr	2,500	2,532	2,366	34,750	70,896	53,360	14,942	19,851	18,676	5,105	4,005	20
Kans	2,000	1,675	933	30,000	55,778	22,924	13,500	18,965	9,857	3,348	687	15
N.C.W. Miss. R	17,318	17,199	15,710	338,575	496,019	432,662	140,976	147,412	153,497	33,521	33,890	25.9
Ky	170	175	174	3,128	4,375	2,406	1,564	1,969	1,227	110	48	6
Tenn	315	342	342	6,142	7,866	4,721	3,071	3,618	2,502	174	80	21
Ala	283	283	257	5,434	5,236	3,251	3,586	3,142	2,276	182	50	2
Miss	130	120	97	2,392	2,304	1,269	1,555	1,267	863	46	20	2
La	40	36	30	840	774	420	546	379	260	35	7	4
Tex	737	688	440	18,499	24,080	7,035	9,989	11,318	4,361	795	105	22
Okla	909	699	609	8,181	25,514	16,606	3,927	9,440	7,639	816	166	12
Ark	205	207	197	4,100	5,692	3,213	2,173	2,618	1,896	245	48	4
S. Central	2,789	2,550	2,146	48,716	75,841	38,921	26,411	33,751	21,024	2,403	524	14.1
Mont	425	390	333	21,165	14,820	13,806	8,466	6,817	5,798	1,169	966	41
Wyo	190	161	124	6,555	5,152	3,361	3,278	2,576	1,681	148	187	18
Colo	290	284	276	10,150	11,104	7,643	4,872	5,108	4,051	588	266	23
N. Mex	48	42	34	1,862	1,151	721	1,061	714	476	22	28	20
Ariz	6	5	6	252	200	189	151	180	150	5	3	24
Utah	87	85	81	3,889	3,655	3,221	1,828	1,754	1,675	185	160	28
Nev	8	7	8	360	313	335	223	197	198	5	8	20
Idaho	331	319	303	14,564	12,282	11,328	5,826	5,158	5,664	800	678	50
Wash	281	275	270	14,528	11,770	13,228	6,538	5,650	6,349	401	528	53
Oreg	359	355	339	12,457	12,248	10,881	5,481	5,757	5,658	525	654	36
Cal	210	200	192	7,140	7,400	4,144	4,213	3,700	2,735	326	164	60
Far Western	2,235	2,123	1,966	92,922	80,095	68,857	41,937	37,611	34,435	4,174	3,642	40.3
U. S	37,763	37,548	35,159	922,298	1,186,341	1,007,129	414,663	408,388	405,120	67,793	64,199	28.8

[1] Percentage of 1911 crop which was shipped out of county of growth.

OATS—Continued.

Average yield per acre and farm price per bushel in the United States.

State and Division.	Yield per acre.						Farm price per bushel Dec. 1.								
	10-year averages.						10-year averages for Dec. 1.					Quarterly, 1911.			
	1870–1879	1880–1889	1890–1899	1900–1909	1910	1911	1870–1879	1880–1889	1890–1899	1900–1909	Dec. 1, 1910	Mar. 1	June 1	Sept. 1	Dec. 1
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Maine	26.0	28.2	34.7	37.0	42.4	38.5	49	44	40	49	48	45	47	54	54
New Hampshire	36.0	32.3	34.0	32.3	42.8	33.8	50	46	42	50	51	45	48	59	61
Vermont	35.4	33.1	36.1	36.0	41.5	35.0	44	42	40	48	50	45	49	57	59
Massachusetts	31.9	29.9	32.8	33.1	35.5	35.0	53	48	41	50	50	48	49	55	58
Rhode Island	30.7	28.0	29.0	29.4	35.0	29.0	51	49	42	50	48	54	49	56	58
Connecticut	29.9	28.1	27.2	31.9	36.8	35.1	53	46	40	47	44	41	41	48	56
New York	32.9	28.6	27.8	31.3	34.5	29.5	41	39	34	43	42	39	43	47	51
New Jersey	28.8	26.8	26.3	28.0	37.1	28.5	42	39	36	44	44	37	39	48	50
Pennsylvania	30.8	28.1	26.6	29.3	35.2	28.3	38	37	34	42	41	41	42	46	50
North Atlantic	31.6	28.5	28.0	30.8	35.5	29.6	40.4	38.8	34.7	43.2	42.3	40.4	43.1	47.6	51.1
Delaware	21.5	21.0	20.9	25.4	33.8	30.0	37	37	32	43	43	32	40	....	47
Maryland	19.8	20.1	20.9	25.1	30.0	27.0	38	37	33	41	46	41	43	43	49
Virginia	15.1	11.8	14.0	17.6	22.0	20.0	40	41	34	45	49	53	52	53	54
West Virginia	23.6	17.7	20.7	22.1	25.2	22.0	35	37	36	45	50	50	52	54	56
North Carolina	14.4	9.5	12.0	14.8	18.2	16.5	52	49	42	54	60	60	59	59	63
South Carolina	12.0	10.5	12.6	17.1	21.0	20.4	72	61	51	62	65	60	60	63	72
Georgia	12.9	9.8	12.5	15.3	18.2	21.5	68	60	50	60	64	62	59	64	70
Florida	13.4	10.2	11.1	13.5	16.2	13.5	88	70	57	64	65	71	63	68	75
South Atlantic	15.6	11.3	13.6	16.9	20.4	20.2	47.8	49.3	42.2	53.7	58.9	57.8	56.7	59.2	65.2
Ohio	29.5	30.7	29.7	33.2	37.2	32.1	30	33	28	36	35	33	35	41	45
Indiana	26.1	27.2	27.3	29.0	35.4	28.7	28	30	27	34	31	30	33	38	43
Illinois	30.1	34.2	29.6	31.2	38.0	28.8	25	27	25	34	30	29	31	39	42
Michigan	32.4	32.3	28.7	31.6	34.0	28.6	34	33	30	37	35	31	34	38	46
Wisconsin	34.6	30.4	32.8	33.3	29.8	29.8	29	30	26	34	34	33	34	39	45
N. C. E. Miss. R	30.2	31.9	29.9	31.0	35.4	29.5	28.3	29.2	26.2	34.6	32.2	30.7	32.8	39.0	43.8
Minnesota	34.0	33.4	31.0	31.7	28.7	22.8	29	27	24	31	32	29	31	37	40
Iowa	34.4	32.2	31.2	29.5	37.8	25.5	22	24	23	30	27	26	29	36	41
Missouri	27.6	26.1	21.9	23.4	33.6	14.8	26	28	25	35	32	34	34	41	45
North Dakota	....	30.7	26.7	29.7	7.0	23.5	....	28	26	31	37	34	36	40	41
South Dakota			23.6	31.6	23.0	7.4			23	30	30	26	29	36	43
Nebraska	32.2	28.5	24.4	26.4	28.0	13.9	23	22	23	30	28	30	28	37	43
Kansas	31.7	28.0	22.4	24.4	33.3	15.0	25	26	24	35	34	32	34	40	45
N. C. W. Miss. R	32.0	30.1	27.1	28.8	28.8	19.6	24.6	25.4	23.3	30.8	29.7	28.5	30.2	37.1	41.6
Kentucky	22.2	18.2	19.4	20.9	25.0	18.4	37	36	33	42	45	47	47	48	50
Tennessee	18.4	13.6	15.2	19.4	23.0	19.5	39	39	33	44	46	48	47	49	50
Alabama	14.2	10.7	13.1	15.6	18.5	19.2	69	60	48	58	60	58	58	62	66
Mississippi	15.0	11.2	13.5	16.7	19.2	18.4	77	60	48	56	55	56	53	59	65
Louisiana	16.8	12.7	15.4	16.9	21.5	21.0	85	57	44	51	49	57	65	61	65
Texas	28.7	23.8	24.4	27.8	35.0	25.1	67	44	37	48	47	44	46	51	54
Oklahoma	....	....	....	29.4	36.5	9.0	....	....	....	38	37	40	42	46	48
Arkansas	23.3	16.7	18.4	20.0	27.5	20.0	54	48	37	47	46	47	47	51	53
South Central	20.4	16.0	18.4	23.9	29.7	17.5	45.6	44.9	37.1	43.8	44.5	45.2	46.5	50.5	54.2
Montana	....	33.6	36.3	43.3	38.0	49.8	....	48	40	42	46	42	42	39	40
Wyoming	....	29.7	31.5	35.9	32.0	34.5	....	47	42	47	50	50	51	50	50
Colorado	[1] 32.4	30.8	28.6	35.3	39.1	35.0	[1] 67	53	38	47	46	44	50	54	48
New Mexico	....	22.3	29.6	29.9	27.4	38.8	....	50	48	59	62	60	65	58	57
Arizona	....	....	....	33.3	40.1	42.0	....	....	....	68	90	48	58	65	60
Utah	....	26.2	32.4	40.2	43.0	44.7	....	44	38	48	48	51	48	44	47
Nevada	33.9	29.8	....	38.6	44.7	45.0	90	62	....	65	63	73	65	66	62
Idaho	....	31.3	35.3	41.7	38.5	44.0	....	49	38	45	42	39	44	44	40
Washington	....	36.4	30.2	46.3	42.8	51.7	....	42	37	43	48	43	47	44	45
Oregon	34.3	28.2	28.1	30.0	34.5	34.7	50	42	37	44	47	43	44	38	44
California	32.1	26.2	28.8	31.2	37.0	34.0	71	53	47	56	50	44	52	48	59
Far Western	32.8	29.3	31.6	36.9	37.7	41.6	62.5	46.4	38.6	45.7	47.0	43.6	46.7	44.4	45.1
United States	28.4	26.5	26.2	29.5	31.6	24.4	33.7	32.0	27.8	35.5	34.4	32.8	34.7	40.4	45.0

[1] The Territories.

OATS—Continued.

Wholesale prices of oats per bushel, 1898–1911.

Date.	New York.		Baltimore.		Cincinnati.		Chicago.		Milwaukee.		Duluth.		Detroit.		San Francisco.	
	No. 2 mixed.		No. 2 mixed.		No. 2 mixed.		Contract.[1]		No. 3 white.		No. 3.[2]		No. 3 white.[3]		No. 1 white (per 100 lbs.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*		
1898....	25½	36	24	36	21½	34½	20¼	32	22¾	34½	20	33¼	23¼	36¼	$1.15	$1.42½
1899....	25¾	35½	24½	35	21½	31½	19¼	28¼	22¾	31½	19½	30½	23½	33	1.22½	1.45
1900....	24¾	29¾	24	29½	21	28	21	26¼	24	29	22½	28	24	29¼	1.22½	1.40
1901....	28¼	52	28	53	25	50¾	23¼	48¼	25½	48¾	25¼	46⅞	28	60½	1.02½	1.55
1902....	32	65	29	60	27	57	25	56	30½	58	27½	47⅛	34¾	61	1.15	1.50
1903....	38	44½	34½	44	31½	43½	31¼	45	33½	41	31	40	35½	45	1.17½	1.37½
1904....	34½	55½	33	48	31	44½	28¼	46	28½	45	27¾	43	31¾	48¼	1.25	1.60
1905....	29	37½	27½	37	25	35½	25	34¼	27⅛	35½	25¼	32¾	26¼	37	1.37½	1.80
1906....	34	45	33½	45½	30	43	28⅞	42¾	29	43	28⅛	41	32	43¼	......	......
1907....	38½	63	39½	59½	37	55½	33½	56½	32¾	56	33½	53	37	58	1.30	1.85
1908.																
Jan.....	53	53½	53	54½	51½	52½	48¼	51½	49	52¼	46½	49	53¼	54	1.55	1.70
Feb....	53	57½	52½	56½	50½	53	48¼	53⅜	47½	53	47	50	53	55½	1.55	1.70
Mar....	55	57	56	57½	52½	54	52⅛	54⅝	50½	54½	49½	51	54¾	56	1.45	1.65
Apr....	54	54½	55½	56½	51	53	51¾	53⅞	50	53¼	47	49½	55	57	1.50	1.65
May....	53½	57	56	57	50½	54½	52¾	56½	51½	56	49	51	55	56	1.47½	1.62½
June...	52½	56	55½	57½	52	54½	50	53	48	54½	48½	50½	55	56	1.40	1.57½
July....	53½	61½	57	62	50	60	51	60½	47½	62½	49	57	55	64	1.40	1.55
Aug....	50½	59½	50½	62	48	51½	46	50	45	47	46⅜	56	47	62	1.45	1.60
Sept...	52	53	51	52	50	53	48	50¼	46	51¼	46¾	49½	49	53	1.60	1.67½
Oct....	51	53	50½	51½	47	51½	46¾	49	45½	52	45¾	47¾	50½	52½	1.60	1.68¾
Nov....	51½	55	51	54	48	52½	47¾	49½	47	53	46	48½	51½	53	1.65	1.75
Dec....	52½	56	53	55	50½	52½	48⅜	50½	48¼	52½	47½	50	51	54	1.70	1.75
Year.	51	61½	50½	62	47	60	46	60½	45	62½	45¾	57	47	64	1.40	1.75
1909.																
Jan.....	53½	54	54	54½	51	53½	49¼	50¼	49	51½	48¼	49⅛	52	53¼	1.70	1.90
Feb....	53½	57½	54	56	53	55	50	55¼	50½	55	48¾	51⅞	53½	57	1.85	1.92½
Mar....	56½	58	55½	58	53½	56½	52⅝	55⅜	51¼	55½	50½	53	55	57	1.87½	2.02½
Apr....	56½	58½	56	58	53½	56½	53	56¼	52½	56½	51⅛	53¾	57¼	57⅝	2.05	2.25
May....	58½	62	58	62½	56	62	56¼	62½	56	62½	53¾	58½	57½	64½	2.15	2.25
June...	59½	61½	58½	62½	55	60½	53¾	59	49	59½	50	57½	56½	62½	2.05	2.25
July....	52½	59½	51	58½	45	55½	44½	53½	46	55½	40	50	50½	56½	1.95	2.15
Aug....	39½	52½	38½	52	35½	45	36½	43	35½	50	33	37½	36½	51	......	......
Sept...	39½	42	38½	42½	35½	42½	37¾	48	37	41½	34¼	38¼	39	41½	......	......
Oct....	41	42½	42	43	40	43	38⅛	41½	38½	42	35⅞	38½	41	43½	1.55	1.62½
Nov....	42	43	42½	43½	40½	42½	38⅜	39¾	38½	42½	36¼	39⅜	41	41½	1.57½	1.70
Dec....	42½	47	43	49	41	47½	40	45	40	45½	39½	43¾	42	46½	1.65	1.80
Year.	39½	62	38½	62½	35½	62	36½	62½	35½	62½	33	58½	36½	64½	1.55	2.25
1910.																
Jan....	47	52	48½	53	47	52	44½	48½	45¼	49½	43¾	47½	47½	51	1.60	1.75
Feb....	50	51	51	53	48	50	46¼	49	46	49¼	44½	46¾	44½	50	1.60	1.66¼
Mar....	48½	50	48	52	46	49½	43	47¼	41½	47¼	41⅜	46	47¼	48½	1.60	1.67½
Apr....	46	48½	46½	49	42½	47½	41½	43½	40	43½	39⅜	41½	44	46½	1.50	1.60
May....	42½	46½	44	47½	40	44½	36½	43¼	37	43	35⅝	41⅝	41	45¼	1.50	1.57½
June...	41	45	43	44½	37	41	35	40¼	35¾	40¼	35	39⅛	41	43	1.42½	1.55
July....	45	48½	44	47	39	44½	38¾	44½	38	46	38⅜	43¾	40½	48½	1.42½	1.65
Aug....	35	47½	42½	47	32½	38½	32¾	38¾	33½	42	33⅛	38⅝	34½	43	1.57½	1.70
Sept...	Nominal.		35½	37½	32½	34½	31⅜	34½	32¾	35½	31¼	35	34½	37	1.50	1.62½
Oct....	Nominal.		36	36	32	35	29¾	32¾	30½	35	29	32⅞	35½	36	1.47½	1.60
Nov....	Nominal.		......	......	31½	34½	30⅝	31¾	31½	33½	31	32¼	34½	35	1.47½	1.50
Dec....	Nominal.		......	......	32½	35	31	32½	31¾	34¼	30¾	33⅛	34	37	1.45	1.50
Year.	47	52	35½	53	31½	52	29¾	49	30½	49½	29	47½	34	51	1.42½	1.75
	No. 2 white.		No. 2 white.										Standard.			
1911.																
Jan....	38	39½	37	38¾	33½	35	30⅞	32¼	31¾	34½	31¼	33	34	35	1.45	1.50
Feb....	36	38	35½	37	31½	34½	30	31¼	29¾	32½	29	31¼	32½	34	1.45	1.47½
Mar....	35½	37	35½	37	31	33½	28⅞	30½	29¾	33	28⅜	30½	32	33	1.42½	1.47½
Apr....	36¼	40	35½	38¼	31	34½	29⅛	32½	30¼	33¾	29⅝	32½	33	36¾	1.45	1.60
May....	39½	43	38¼	40¾	33½	37	31⅞	36	32¾	36	31⅞	35¼	35	38	1.35	1.40
June...	43½	50½	40¾	49	37	44	35⅞	43¼	36	44	35⅝	43½	37¾	45	1.50	1.60
July....	46½	53½	44	53	38	49	38½	46¾	38½	49	38⅜	46⅝	41	50	1.45	1.55
Aug....	46½	48	43	46	39	44	39⅜	42½	39	43¾	41	43⅛	41	43½	1.47½	1.60
Sept...	47½	53½	45	50	43½	48½	42⅝	46	43¾	48	42½	46¼	45	49½	1.57½	1.65
Oct....	53	54	50½	51¾	48	49½	45⅛	47¼	47	48¾	45	46⅝	49	50½	1.62½	1.80
Nov....	53	55	50½	54	47½	51	44¾	47⅝	46½	49	44½	46¼	49	51	1.72	1.85
Dec....	53½	55	52½	54½	48½	51½	46¼	47⅜	46	48½	43⅝	46⅜	50	51	1.62½	1.85
Year.	35½	55	35½	54½	31	51½	28⅞	47⅝	29¾	49	28⅜	46⅝	32	51	1.35	1.85

[1] No. 2 grade, 1898–1906. [2] No. 2 grade from 1898 to 1904 and 1906; "no grade" in 1905. [3] No. 2 white, 1898-1906.

OATS—Continued

Average farm price of oats per bushel on the first of each month, 1910–1911.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States east of Miss. R.		N. Cen. States west of Miss. R.		South Central States.		Far Western States.	
	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	33.2	42.8	41.5	50.7	58.5	66.4	31.1	41.8	28.9	38.1	45.3	56.9	42.0	51.2
February	33.1	45.0	41.3	52.5	58.9	66.6	31.4	44.5	28.3	40.2	45.7	59.5	42.9	51.4
March	32.8	46.0	40.4	54.9	57.8	67.9	30.7	45.3	28.5	41.0	45.2	61.7	43.6	53.9
April	32.3	45.6	40.8	56.1	57.5	68.3	30.5	44.2	27.6	40.8	44.9	61.6	42.4	53.0
May	33.2	43.3	41.7	55.3	56.7	66.7	31.5	42.2	28.7	37.7	43.7	60.0	44.5	52.4
June	34.7	43.0	43.1	54.0	56.7	67.2	32.8	41.6	30.2	37.5	46.5	58.4	46.7	53.9
July	37.5	42.1	44.9	52.3	57.1	66.0	33.7	40.9	35.6	37.7	48.5	51.0	47.0	51.0
August	40.2	41.7	48.7	52.6	58.8	64.2	37.8	39.4	37.1	38.6	50.7	47.1	46.7	51.7
September	40.4	38.4	47.6	48.8	59.2	63.9	39.0	35.1	37.1	34.6	50.5	46.4	44.4	50.9
October	42.5	36.2	48.5	46.3	60.4	63.0	41.4	33.7	39.7	32.3	52.1	46.1	43.5	48.1
November	43.8	34.9	48.8	43.7	62.7	61.2	43.0	33.2	40.9	30.6	53.2	45.3	44.6	46.0
December	45.0	34.1	51.1	42.4	65.2	58.4	43.8	32.2	41.6	29.5	54.2	44.9	45.1	47.3

BARLEY.

Barley area of countries named, 1907–1911.

Country.	1907	1908	1909	1910	1911
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	6,448,000	6,646,000	7,698,000	7,743,000	7,627,000
Canada:					
New Brunswick	4,100	3,500	3,200	2,900	2,600
Ontario	766,900	743,800	721,500	696,700	521,400
Manitoba	649,600	662,500	696,000	684,000	433,100
Saskatchewan	79,300	81,000	135,000	137,400	172,300
Alberta	54,700	129,800	186,000	194,500	156,400
Other	128,700	125,100	123,200	118,500	118,600
Total Canada	1,683,300	1,745,700	1,864,900	1,834,000	1,404,400
Mexico	(1)	(1)	(1)	(1)	(1)
EUROPE.					
Austria-Hungary.					
Austria	2,882,500	2,757,200	2,795,500	2,721,900	2,709,900
Hungary proper	2,725,200	2,647,500	2,857,800	2,715,700	2,737,100
Croatia-Slavonia	160,900	159,800	156,700	159,600	158,200
Bosnia-Herzegovina	292,100	262,200	204,400	202,600	179,900
Total Austria-Hungary	6,060,700	5,826,700	6,014,400	5,799,800	5,785,100
Belgium	92,000	87,900	87,500	(1)	(1)
Bulgaria	573,800	621,100	596,000	643,300	(1)
Denmark	577,500	(1)	(1)	(1)	(1)
Finland	(1)	(1)	(1)	(1)	(1)
France	1,761,500	1,802,800	1,814,700	1,849,500	1,901,900
Germany	4,205,000	4,025,200	4,068,200	3,880,500	3,916,700
Italy	(1)	(1)	617,100	611,700	611,800
Netherlands	76,500	74,600	70,200	69,400	69,100
Norway	88,500	(1)	(1)	(1)	(1)
Roumania	1,259,500	1,532,500	1,357,100	1,357,500	1,253,300
Russia:					
Russia proper	20,403,200	21,913,700	21,801,100	....	....
Poland	1,212,200	1,243,100	1,236,400	....	....
Northern Caucasia	2,533,100	2,790,400	2,965,800	....	....
Total Russia (European) [2]	24,148,500	25,947,200	26,003,300	27,758,300	(1)
Servia	250,200	254,800	261,900	241,700	(1)
Spain	3,561,100	3,466,700	3,480,000	3,333,200	3,567,400
Sweden	487,000	483,000	476,900	456,400	(1)

[1] No official statistics of area. [2] Exclusive of winter barley.

BARLEY—Continued.

Barley area of countries named, 1907–1911—Continued.

Country.	1907	1908	1909	1910	1911
EUROPE—continued.					
United Kingdom:					
Great Britain—	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
England	1,411,200	1,383,300	1,379,100	1,449,500	1,337,400
Scotland	210,300	197,400	200,000	191,600	173,600
Wales	90,600	86,700	85,300	87,600	86,800
Ireland	170,400	154,600	163,100	168,000	158,200
Total United Kingdom	1,882,500	1,822,000	1,827,500	1,896,700	1,756,000
ASIA.					
Cyprus	(1)	(1)	(1)	(1)	(1)
Japanese Empire:					
Japan	3,316,900	3,266,300	3,136,200	3,176,500	(1)
Formosa	(1)	(1)	(1)	(1)	(1)
Russia:					
Central Asia	216,500	232,900	292,400	....	....
Siberia	315,800	355,600	412,600	....	....
Transcaucasia	700	1,100	800	....	....
Total Russia (Asiatic) [2]	533,000	589,600	705,800	693,300	(1)
AFRICA.					
Algeria	3,168,600	3,442,600	3,284,000	3,418,400	3,320,500
Egypt	472,700	475,800	457,300	403,800	(1)
Tunis	1,188,500	1,088,800	1,109,500	1,186,100	(1)
Union of South Africa	(1)	(1)	(1)	(1)	(1)
AUSTRALASIA.					
Australia:					
Queensland	8,600	6,900	7,400	13,100	5,600
New South Wales	7,900	11,900	9,500	15,100	7,100
Victoria	52,800	63,100	65,200	58,600	52,700
South Australia	28,100	37,300	44,900	41,900	34,500
Western Australia	3,600	6,000	7,300	8,000	3,400
Tasmania	5,300	5,900	6,500	6,300	5,200
Total Australia	106,300	131,100	140,800	143,000	108,500
New Zealand	36,700	36,200	48,900	41,500	33,000
Total Australasia	143,000	167,300	189,700	184,500	141,500

[1] No official statistics of area. [2] Exclusive of winter barley.

Barley crop of countries named, 1907–1911.

Country.	1907	1908	1909	1910	1911
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	153,597,000	166,756,000	173,321,000	173,832,000	160,240,000
Canada:					
New Brunswick	97,000	79,000	94,000	73,000	74,000
Ontario	21,718,000	21,124,000	20,952,000	20,727,000	13,760,000
Manitoba	16,753,000	17,093,000	20,866,000	13,826,000	14,447,000
Saskatchewan	1,350,000	1,952,000	4,493,000	3,598,000	5,445,000
Alberta	1,083,000	3,881,000	5,999,000	3,953,000	4,151,000
Other	3,341,000	2,633,000	2,994,000	2,971,000	2,764,000
Total Canada	44,342,000	46,762,000	55,398,000	45,148,000	40,641,000
Mexico	7,000,000	7,000,000	7,000,000	6,329,000	6,500,000
Total	204,939,000	220,518,000	235,719,000	225,309,000	207,381,000
EUROPE.					
Austria-Hungary:					
Austria	78,555,000	69,497,000	79,368,000	67,618,000	74,414,000
Hungary proper	63,078,000	56,324,000	71,868,000	53,630,000	72,970,000
Croatia-Slavonia	2,064,000	2,552,000	2,394,000	2,732,000	2,640,000
Bosnia-Herzegovina	2,388,000	2,389,000	3,755,000	3,787,000	2,970,000
Total Austria-Hungary	146,085,000	130,762,000	157,385,000	127,767,000	152,994,000

BARLEY—Continued.

Barley crop of countries named, 1907-1911—Continued.

Country.	1907	1908	1909	1910	1911
EUROPE—continued.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Belgium	5,129,000	4,409,000	4,574,000	3,748,000	4,595,000
Bulgaria	6,772,000	11,311,000	9,322,000	14,083,000	16,000,000
Denmark	21,616,000	20,166,000	21,599,000	21,793,000	23,027,000
Finland	5,124,000	5,131,000	4,887,000	5,000,000	5,000,000
France	43,043,000	40,673,000	46,144,000	43,477,000	47,460,000
Germany	160,650,000	140,539,000	160,552,000	133,330,000	145,132,000
Italy	8,000,000	9,000,000	10,951,000	9,483,000	10,882,000
Netherlands	4,091,000	3,953,000	3,332,000	3,383,000	3,664,000
Norway	2,597,000	3,028,000	2,596,000	2,900,000	2,550,000
Roumania	20,062,000	12,873,000	19,955,000	29,359,000	26,157,000
Russia:					
Russia proper	277,500,000	297,449,000	382,163,000		
Poland	25,395,000	23,790,000	26,671,000		
Northern Caucasia	41,206,000	46,219,000	55,900,000		
Total Russia (European)[1]	344,101,000	367,458,000	464,734,000	448,832,000	401,228,000
Servia	3,137,000	3,351,000	3,123,000	2,067,000	2,500,000
Spain	53,598,000	69,596,000	81,579,000	76,308,000	86,792,000
Sweden	12,811,000	15,520,000	13,900,000	14,763,000	13,725,000
United Kingdom:					
Great Britain—					
England	51,926,000	46,353,000	52,323,000	48,777,000	43,378,000
Scotland	7,466,000	7,410,000	7,731,000	6,578,000	6,490,000
Wales	2,881,000	2,682,000	2,804,000	2,896,000	2,729,000
Ireland	6,934,000	7,064,000	8,258,000	6,846,000	7,099,000
Total United Kingdom	69,207,000	63,509,000	71,116,000	65,097,000	59,696,000
Total	906,023,000	901,279,000	1,075,749,000	1,001,390,000	1,001,402,000
ASIA.					
Cyprus	2,963,000	2,613,000	2,469,000	2,104,000	1,800,000
Japanese Empire:					
Japan	90,480,000	87,138,000	87,185,000	81,953,000	95,533,000
Formosa	50,000	50,000	50,000	50,000	60,000
Total Japanese Empire	90,530,000	87,188,000	87,235,000	82,003,000	95,593,000
Russia:					
Central Asia	4,385,000	4,266,000	4,099,000		
Siberia	4,957,000	6,103,000	4,775,000		
Transcaucasia	4,000	13,000	10,000		
Total Russia (Asiatic)[1]	9,346,000	10,382,000	8,884,000	10,160,000	10,006,000
Total	102,839,000	100,183,000	98,588,000	94,267,000	107,399,000
AFRICA.					
Algeria	41,543,000	31,511,000	50,008,000	48,708,000	47,588,000
Tunis	9,506,000	5,057,000	9,186,000	6,660,000	6,600,000
Union of South Africa	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Total	54,049,000	39,568,000	62,194,000	58,368,000	57,188,000
AUSTRALASIA.					
Australia:					
Queensland	163,900	67,000	142,000	200,000	86,000
New South Wales	158,000	77,000	172,000	281,000	85,000
Victoria	1,295,000	1,093,000	1,706,000	1,056,000	1,383,000
South Australia	507,000	585,000	852,000	713,000	562,000
Western Australia	50,000	79,000	77,000	105,000	35,000
Tasmania	146,000	154,000	190,000	158,000	147,000
Total Australia	2,319,000	2,055,000	3,139,000	2,513,000	2,298,000
New Zealand	1,068,000	1,200,000	2,000,000	1,345,000	950,000
Total Australasia	3,387,000	3,255,000	5,139,000	3,858,000	3,248,000
Grand total	1,271,237,000	1,264,803,000	1,477,389,000	1,383,192,000	1,376,618,000

[1] Exclusive of winter barley.

BARLEY—Continued.

Average yield of barley in countries named, bushels per acre, 1890–1911.

Year.	United States.	Russia, European.[1]	Germany.[1]	Austria.[1]	Hungary proper.[1]	France.[2]	United Kingdom.[2]
Average (1890–1899)	23.4	13.3	29.4	21.1	....	22.6	39.8
Average (1900–1909)	25.5	14.3	35.3	26.3	23.4	23.6	35.0
1902	29.0	15.6	35.0	24.6	24.7	24.5	37.0
1903	26.4	15.5	36.3	24.8	25.1	25.2	33.4
1904	27.2	14.4	33.7	22.8	19.7	22.0	32.3
1905	26.8	14.3	33.3	24.0	24.5	23.4	35.9
1906	28.3	13.0	35.2	26.1	26.8	20.8	36.1
1907	23.8	14.2	38.2	27.3	23.1	24.4	36.8
1908	25.1	14.2	34.9	25.2	21.3	22.6	34.9
1909	22.5	17.9	39.5	28.2	25.1	26.2	38.9
1910	22.5	16.2	34.4	24.8	19.7	23.5	31.5
1911	21.0	....	37.1	27.5	26.3	25.5	34.0
Average (1902–1911)	25.3	....	35.8	25.5	23.6	23.8	35.1

[1] Bushels of 48 pounds. [2] Winchester bushels.

Acreage, production, value, prices, exports, etc., of barley in the United States, 1849–1911.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2.				Domestic exports, fiscal year beginning July 1.	Imports, fiscal year beginning July 1.
						December.		May of following year.			
						Low.	High.	Low.	High.		
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Bushels.*	*Bushels.*
1849[1]	....	.....	*5,167,000*	......	....	.....	.....	.....	.....	....	....
1859[1]	....	.....	*15,826,000*	......	....	.....	.....	.....	.....	....	....
1866	493,000	22.9	11,284,000	70.2	7,916,000	59	70	85	100	....	3,247,250
1867	1,131,000	22.7	25,727,000	70.1	18,028,000	150	180	227	250	9,810	3,783,966
1868	937,000	24.4	22,896,000	109.0	24,948,000	140	170	149	175	59,077	5,069,880
1869	1,026,000	27.9	28,652,000	70.8	20,298,000	74	85	50	62	255,490	6,727,597
1869[1]	....	.....	*29,761,000*	......	....	.....	.....	.....	.....	....	....
1870	1,109,000	23.7	26,295,000	79.1	20,792,000	68	80	72	95	340,093	4,866,700
1871	1,114,000	24.0	26,718,000	75.8	20,264,000	55½	64	55	71	86,891	5,565,591
1872	1,397,000	19.2	26,846,000	68.6	18,416,000	60	70	71	85	482,410	4,244,751
1873	1,387,000	23.1	32,044,000	86.7	27,794,000	132	158	130	155	320,399	4,891,189
1874	1,581,000	20.6	32,552,000	86.0	27,998,000	120	129½	115	137	91,118	6,255,063
1875	1,790,000	20.6	36,909,000	74.1	27,368,000	81	88	62½	72½	317,781	10,285,957
1876	1,767,000	21.9	38,710,000	63.0	24,403,000	63¾	68½	80	85	1,186,129	6,702,965
1877	1,669,000	21.4	35,638,000	62.5	22,287,000	56¼	64	46½	52½	3,921,501	6,764,228
1878	1,790,000	23.6	42,246,000	57.9	24,454,000	91	100	64	73	715,536	5,720,979
1879	1,681,000	24.0	40,283,000	58.9	23,714,000	86	92	75	80	1,128,923	7,135,258
1879[1]	*1,998,000*	*22.0*	*43,997,000*	......	....	.....	.....	.....	.....	....	....
1880	1,843,000	24.5	45,165,000	66.6	30,091,000	100	120	95	105	885,246	9,528,616
1881	1,968,000	20.9	41,161,000	82.3	33,863,000	101	107	100	100	205,930	12,182,722
1882	2,272,000	21.5	48,954,000	62.9	30,768,000	79	82	80	80	433,005	10,050,687
1883	2,379,000	21.1	50,136,000	58.7	29,420,000	62	67	65	74	724,955	8,596,122
1884	2,609,000	23.5	61,203,000	48.7	29,779,000	53	58	65	65	629,130	9,986,507
1885	2,729,000	21.4	58,360,000	56.3	32,868,000	62	65	58	60	252,183	10,197,115
1886	2,653,000	22.4	59,428,000	53.6	31,841,000	51	54	57	57	1,305,300	10,355,594
1887	2,902,000	19.6	56,812,000	51.9	29,464,000	80	80	69	77	550,884	10,831,461
1888	2,996,000	21.3	63,884,000	59.0	37,672,000	.....	.....	.....	.....	1,440,321	11,368,414
1889	3,221,000	24.3	78,333,000	41.6	32,614,000	58	58	.....	.....	1,408,311	11,332,545
1889[1]	*3,221,000*	*24.3*	*78,333,000*	......	....	.....	.....	.....	.....	....	....
1890	3,135,000	21.4	67,168,000	62.7	42,141,000	.....	.....	.....	.....	973,062	5,078,733
1891	3,353,000	25.9	86,839,000	52.4	45,470,000	.....	.....	.....	.....	2,800,075	3,146,328
1892	3,400,000	23.6	80,097,000	47.5	38,026,000	65	67	65	65	3,035,267	1,970,129
1893	3,220,000	21.7	69,869,000	41.1	28,729,000	52	54	55	60	5,219,405	791,061
1894	3,171,000	19.4	61,400,000	44.2	27,134,000	53½	55½	51	52	1,563,754	2,116,816

[1] Census figures.

BARLEY—Continued.

Acreage, production, value, prices, exports, etc., of barley in the United States, 1849-1911—Continued.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, fiscal year beginning July 1.	Imports, fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	(2) *Cents.*	*Cents.*	(2) *Cents.*	*Cents.*	*Bushels.*	*Bushels.*
1895...	3,300,000	26.4	87,073,000	33.7	29,312,000	33	40	25	36	7,680,331	837,384
1896...	2,951,000	23.6	69,695,000	32.3	22,491,000	22	37	24½	35	20,030,301	1,271,787
1897...	2,719,000	24.5	66,685,000	37.7	25,142,000	25½	42	36	53	11,237,077	124,804
1898...	2,583,000	21.6	55,792,000	41.3	23,064,000	40	50½	36	42	2,267,403	110,475
1899...	2,878,000	25.5	73,382,000	40.3	29,594,000	35	45	36	44	23,661,662	189,757
1899 [1]..	*4,470,000*	*26.8*	*119,635,000*	......	....	......	......	......	......	....	....
1900...	2,894,000	20.4	58,926,000	40.9	24,075,000	37	61	37	57	6,293,207	171,004
1901...	4,296,000	25.6	109,933,000	45.2	49,705,000	56	63	64	72	8,714,268	57,406
1902...	4,661,000	29.0	134,954,000	45.9	61,899,000	36	70	48	56	8,429,141	56,462
1903...	4,993,000	26.4	131,861,000	45.6	60,166,000	42	61½	38	59	10,881,627	90,708
1904...	5,146,000	27.2	139,749,000	42.0	58,652,000	38	52	40	50	10,661,655	81,020
1905...	5,096,000	26.8	136,551,000	40.5	54,993,000	37	53	42	55½	17,729,360	18,049
1906...	6,324,000	28.3	178,916,000	41.5	74,236,000	44	56	66	85	8,238,842	38,319
1907...	6,448,000	23.8	153,597,000	66.6	102,290,000	78	102	[3] 60	[3] 75	4,349,078	199,741
1908...	6,646,000	25.1	166,756,000	55.4	92,442,000	[3] 57	[3] 64½	[3] 66	[3] 75	6,580,393	2,644
1909...	7,011,000	24.3	170,284,000	55.2	93,971,000	[3] 55	[3] 72	[3] 50	[3] 68	4,311,566	....
1909 [1]..	*7,698,000*	*22.5*	*173,321,000*	......	....	......	......	......	......	....	....
1910 [4]..	7,743,000	22.5	173,832,000	57.8	100,426,000	[3] 72	[3] 90	[3] 75	[3] 115	9,399,348	....
1911 [4]..	7,627,000	21.0	160,240,000	86.9	139,182,000	[3] 102	[3] 130	......	......	....	....

[1] Census figures.
[2] Prices 1895 and subsequent years are for No. 3 grade.
[3] Low malting to fancy.
[4] Figures adjusted to census basis.

Acreage, production, and farm value of barley the in United States in 1911.

State and Division.	Acreage.	Production.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Dollars.*
Maine..........	4,000	112,000	101,000
N. Hampshire..	1,000	24,000	21,000
Vermont.......	12,000	366,000	300,000
New York.....	80,000	2,000,000	1,940,000
Pennsylvania..	7,000	175,000	114,000
N. Atlantic..	104,000	2,677,000	2,476,000
Maryland......	4,000	92,000	55,000
Virginia........	10,000	230,000	161,000
S. Atlantic...	14,000	322,000	216,000
Ohio...........	20,000	544,000	457,000
Indiana........	9,000	238,000	178,000
Illinois.........	55,000	1,540,000	1,417,000
Michigan	90,000	2,160,000	1,858,000
Wisconsin	820,000	20,910,000	20,701,000
N. C. E. of Miss. River.	994,000	25,392,000	24,611,000
Minnesota......	1,475,000	28,025,000	26,904,000
Iowa...........	500,000	10,950,000	10,184,000
Missouri.......	6,000	120,000	90,000
North Dakota..	1,050,000	20,475,000	17,404,000
South Dakota..	1,020,000	5,508,000	4,847,000
Nebraska......	120,000	1,320,000	792,000
Kansas.........	250,000	1,625,000	975,000
N. C. W. of Miss. River.	4,421,000	68,023,000	61,196,000
Kentucky......	3,000	86,000	68,000
Tennessee......	3,000	84,000	76,000
Texas..........	5,000	90,000	84,000
Oklahoma.....	10,000	100,000	61,000
S. Central....	21,000	360,000	289,000
Montana.......	31,000	1,070,000	728,000
Wyoming......	11,000	374,000	280,000
Colorado.......	74,000	2,146,000	1,481,000
New Mexico...	2,000	66,000	46,000
Arizona........	35,000	1,278,000	1,112,000
Utah..........	24,000	1,032,000	681,000
Nevada........	12,000	480,000	389,000
Idaho..........	142,000	5,964,000	4,175,000
Washington....	176,000	6,512,000	4,428,000
Oregon.........	116,000	3,944,000	2,564,000
California......	1,450,000	40,600,000	34,510,000
Far Western.	2,073,000	63,466,000	50,394,000
United States	7,627,000	160,240,000	139,182,000

BARLEY—Continued.

Condition of the barley crop in the United States on the first of months named, 1890–1911.

Year.	June.	July.	August.	When harvested.	Year.	June.	July.	August.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1890	86.4	88.3	82.8	78.6	1901	91.0	91.3	86.9	83.8
1891	90.3	90.9	93.8	94.3	1902	93.6	93.7	90.2	89.7
1892	92.1	92.0	91.1	87.4	1903	91.5	86.8	83.4	82.1
1893	88.3	88.8	84.6	83.8	1904	90.5	88.5	88.1	87.4
1894	82.2	76.8	69.8	71.5	1905	93.7	91.5	89.5	87.8
1895	90.3	91.9	87.2	87.6	1906	93.5	92.5	90.3	89.4
1896	98.0	88.1	82.9	83.1	1907	84.9	84.4	84.5	78.5
1897	87.4	88.5	87.5	86.4	1908	89.7	86.2	83.1	81.2
1898	78.8	85.7	79.3	79.2	1909	90.6	90.2	85.4	80.5
1899	91.4	92.0	93.6	86.7	1910	89.6	73.7	70.0	69.8
1900	86.2	76.3	71.6	70.7	1911	90.2	72.1	66.2	65.5

Yield per acre and farm price per bushel of barley in the United States.

State and Division.	Yield per acre. 10-year averages. 1870–1879	1880–1889	1890–1899	1900–1909	1910	1911	Farm price per bushel. 10-year averages for Dec. 1. 1870–1879	1880–1889	1890–1899	1900–1909	Dec. 1, 1910.	Quarterly, 1911. Mar. 1.	June 1.	Sept. 1.	Dec. 1.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Maine	20.2	21.8	26.5	29.2	31.0	28.0	78	74	61	71	76	75	86	80	90
New Hampshire	23.8	21.9	24.5	22.1	26.0	24.0	84	74	65	76	77	67	84	84	86
Vermont	25.1	24.8	28.7	30.6	31.0	30.5	84	72	56	64	68	67	79	82	82
New York	22.0	22.7	22.0	24.6	28.3	25.0	79	72	59	60	70	74	78	85	97
Pennsylvania	22.2	20.5	20.2	22.4	26.5	25.0	84	72	50	58	63	66	63	63	65
N. Atlantic	21.9	22.6	22.6	25.3	28.5	25.7	79.5	72.4	59.1	61.6	69.6	72.2	77.9	82.8	92.6
Maryland	18.2	25.3	22.4	27.7	31.0	23.0	79	74	55	55	61	50	65	60	60
Virginia	17.1	16.5	19.5	26.0	29.3	23.0	72	72	58	59	67	59	70	70	70
S. Atlantic	15.0	15.8	21.2	26.6	29.8	23.0	80.4	78.4	56.2	57.7	65.2	59.0	70.0	70.0	67.1
Ohio	24.0	22.1	25.4	27.3	28.5	27.2	75	70	49	53	60	63	68	75	84
Indiana	22.5	22.3	21.1	25.4	27.0	26.5	79	66	47	53	56	57	62	64	75
Illinois	22.4	21.7	23.6	27.8	30.2	28.0	62	60	45	50	56	57	69	75	92
Michigan	22.5	23.3	21.8	25.0	26.0	24.0	76	66	50	55	58	64	75	70	86
Wisconsin	26.3	23.9	27.1	28.6	25.9	25.5	66	55	42	51	64	80	84	90	99
N. C. E. Miss. R.	23.8	23.2	26.1	28.2	26.2	25.5	68.0	58.6	43.7	51.0	62.7	77.4	82.2	87.5	96.9
Minnesota	26.1	24.2	26.2	25.7	21.0	19.0	52	48	35	42	60	71	81	85	96
Iowa	23.8	22.2	23.9	25.6	29.5	21.9	48	47	34	41	56	63	73	80	93
Missouri	21.7	20.4	19.9	21.9	27.0	20.0	73	59	44	55	60	75	75	75	75
North Dakota	.....	20.9	22.8	23.0	5.5	19.5	.....	42	32	38	55	61	68	85	85
South Dakota	.....	20.2	20.5	25.3	18.2	5.4	.....	42	31	39	57	71	75	85	88
Nebraska	25.2	19.4	20.8	24.0	18.5	11.0	45	39	32	37	45	48	53	55	60
Kansas	22.4	18.9	16.8	19.8	18.0	6.5	52	45	35	41	45	46	49	52	60
N. C. W. Miss. R.	23.9	21.8	23.8	24.6	17.4	15.4	48.8	45.7	33.8	40.5	56.7	66.1	73.6	80.6	90.0
Kentucky	23.1	21.8	21.7	24.0	24.0	28.7	82	66	46	63	65	80	.....	74	79
Tennessee	19.4	13.9	16.6	20.4	23.0	28.0	76	68	57	66	80	82	82	83	90
Texas	27.8	16.9	17.3	22.4	30.0	18.0	94	69	59	75	90	.....	.....	100	93
Oklahoma	.....	.....	.....	26.2	30.0	10.0	.....	.....	.....	47	54	57	68	73	61
S. Central	23.1	19.0	19.0	24.6	28.2	17.1	81.8	66.2	52.5	53.9	66.8	57.0	68.0	77.5	80.3
Montana	.....	28.6	29.8	36.2	28.0	34.5	.....	67	57	57	62	53	80	84	68
Wyoming		.....	24.3	29.9	30.0	34.0		.....	65	67	67	77	75	.....	75
Colorado	[1] 29.4	24.2	26.9	33.8	32.0	29.0	[1] 94	75	55	59	60	53	63	67	69
New Mexico	.....	20.1	25.5	28.0	25.0	33.0	.....	73	63	73	80	50	.....	62	70
Arizona	.....	19.8	23.6	35.6	36.0	36.5	.....	70	66	81	90	54	62	67	87
Utah	.....	22.9	29.9	38.4	36.0	43.0	.....	58	50	57	60	61	59	53	66
Nevada	27.2	22.9	28.6	35.2	40.0	40.0	124	81	62	76	70	84	87	84	81
Idaho	.....	26.8	28.3	39.8	33.0	42.0	.....	64	48	54	50	46	55	70	70
Washington	.....	29.0	33.9	38.0	29.0	37.0	.....	56	45	50	57	50	63	64	68
Oregon	27.9	25.7	27.0	32.2	31.5	34.0	65	54	47	55	62	56	63	70	65
California	20.8	20.6	20.9	24.5	31.0	28.0	82	62	53	61	55	52	72	67	85
Far Western	21.2	21.2	22.0	27.0	31.2	30.6	83.2	62.6	51.9	58.7	56.4	52.2	70.1	67.4	79.4
United States	22.2	22.0	23.4	25.7	22.5	21.0	71.3	58.2	43.3	47.9	57.8	63.0	73.8	77.0	86.9

[1] The Territories.

BARLEY—Continued.

Average farm price of barley per bushel on the first of each month, 1910–11.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	59.8	57.6	70.2	71.7	65.0	70.0	70.0	59.4	62.4	49.6	50.0	69.2	51.2	70.7
February	64.1	59.3	73.8	73.3	65.0	67.0	76.1	63.8	68.8	51.9	48.0	75.0	52.4	69.7
March	63.0	60.2	72.2	73.7	59.0	69.0	77.4	63.1	66.1	52.7	57.0	66.4	52.2	71.7
April	69.1	59.7	75.0	77.8	56.0	69.0	85.0	63.1	75.2	51.3	57.0	63.0	54.0	72.6
May	74.0	56.5	75.5	77.1	64.0	72.0	86.7	60.2	79.5	47.9	58.3	69.8	61.5	69.1
June	73.8	55.7	77.9	80.8	70.0	65.0	82.2	61.3	73.6	47.7	68.0	61.5	70.1	66.1
July	70.1	53.9	74.4	74.8	62.0	69.0	81.6	60.4	72.8	48.8	47.0	60.6	61.4	58.5
August	69.3	54.7	80.5	77.2	67.0	69.0	78.8	62.2	71.8	51.1	55.7	49.0	61.5	55.8
September	77.0	57.2	82.8	73.7	70.0	70.0	87.5	62.9	80.6	54.2	77.5	54.9	67.4	58.7
October	81.7	56.1	87.5	71.7	65.0	68.0	96.4	61.5	85.4	54.0	74.2	58.6	70.1	55.9
November	84.9	55.3	91.9	70.3	65.0	67.0	99.1	61.0	89.4	53.6	65.8	60.6	72.8	54.0
December	86.9	57.8	92.5	69.8	67.1	65.5	96.9	63.1	90.0	56.5	80.3	59.4	79.4	56.4

Wholesale prices of barley per bushel, 1898–1911.

Date.	Cincinnati.		Chicago.		Milwaukee.		San Francisco.	
	Extra No. 3 spring.		No. 3.		Extra No. 3.		No. 1 brewing (per 100 lbs.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Dollars.*	*Dollars.*
1898	32	54	26½	53	....	....	0.92½	1.42½
1899	44	56	34	54	....	....	.85	1.47½
1900	44¾	66	34	62	....	....	.67½	.75
1901	58	70	36	65	....	....	.73¾	.85
1902	55	74	35	73	....	....	.80	1.32½
1903	55	71	42	63	48	63	.90	1.22½
1904	55	69	35	61	41	61	[1] .95	[1] 1.15
1905	52	58	36½	55	41	54	[1] 1.02½	[1] 1.35
1906	52	62	38	58	43½	56	....	....
1907	54	113	45	110	49	111	1.12½	1.72½
			Low malting to Fancy.				No. 1 feed.	
1908.								
January	113	115	78	106	85	105	1.35	1.57½
February	102	115	80	95	78	95	1.25	1.42½
March	102	110	72	93	75	90	1.25	1.42½
April	98	110	65	87	68	86	1.32½	1.42½
May	....	....	60	75	64	71	1.37½	1.50
June	....	....	49	66	50	66	1.22½	1.42½
July	....	....	57	74	60	61	1.25	1.40
August	68	70	60	68	59	67	1.25	1.38¾
September	67	73	56	67	56	65½	1.25	1.36¼
October	67	71	53	62	57	66	1.32½	1.42½
November	67	71	54½	67	58	66½	1.40	1.47½
December	67	69	57	64½	59	65¼	1.40	1.45
Year	67	115	49	106	50	105	1.22½	1.57½
1909.								
January	67	70	59	66	62	66	1.36¼	1.43¾
February	70	71	60½	66½	62	66½	1.37½	1.42½
March	71	72	63	68	63	67½	1.40	1.50
April	71	72	62	68	63½	68	1.47½	1.65
May	73	74	66	75	60	77	1.55	1.70
June	74	84	70	82½	65	82½	1.40	1.60
July	75	76	62	78	64½	72	1.42½	1.48¾
August	....	....	50	70	54	68	1.35	1.45
September	64	68	50	66	59	68	1.35	1.40
October	64	67	50	66	55	67	1.35	1.45
November	66	68	53	67½	60	67	1.43¾	1.47½
December	70	76	55	72	64	70	1.45	1.52½
Year	64	84	50	82½	54	82½	1.35	1.70

[1] No. 1 feed.

BARLEY—Continued.

Wholesale prices of barley per bushel, 1898–1911—Continued.

Date.	Cincinnati.		Chicago.		Milwaukee.		San Francisco.	
	Extra No. 3 spring.		No. 3.		Extra No 3.		No. 1 brewing (per 100 lbs.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.* (1)	*Cents.*	*Dollars.*	*Dollars.*
1910.								
January	76	80	63	74	68	73	1.32½	1.50
February	73	80	64	73	67	72	1.35	1.40
March	69	78	56	73	67	72	1.35	1.45
April	67	74	50	70	59	70½	1.10	1.35
May	67	72	50	68	60	67	1.06¾	1.15
June	70	72	52	69	60	66½	1.00	1.10
July	70	80	50	77	62	75	1.00	1.10
August	75	80	54	75	62	75	.95	1.08¾
September	72	81	60	75	67	74	.97½	1.06¼
October	74	82	63	77	68½	76	.95	1.02½
November	80	86	66	83½	71	82	.95	1.03¾
December	72	86	72	90	74½	90	1.02½	1.11¼
Year	67	86	50	90	59	90	.95	1.50
1911.	No. 3 spring.							
January	90	106	78	100	86	100	1.10	1.15
February	88	100	75	98	82	96	1.11¼	1.16¼
March	90	115	79	114	88	115	1.11¼	1.42½
April	96	115	90	117	100	116	1.40	1.50
May	94	114	75	115	80	113	1.37½	1.50
June	90	108	70	117	80	116	1.23¾	1.40
July	....	....	80	117	94	114	1.26¼	1.35
August	....	....	80	124	93	122	1.32½	1.60
September	95	123	90	125	108	124	1.55	1.67½
October	110	123	98	126	113	125	1.67½	1.90
November	110	125	100	139	118	130	1.82½	1.98½
December	110	125	102	130	120	127	1.75	1.85
Year	88	125	70	130	80	130	1.10	1.98½

[1] Medium No. 3 from May to December, inclusive.

RYE.

Rye area of countries named, 1907–1911.

Country.	1907	1908	1909	1910	1911
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	1,926,000	1,948,000	2,196,600	2,185,000	2,127,000
Canada:					
Ontario	67,200	63,400	57,300	52,500	98,900
Manitoba	6,000	6,300	4,700	3,800	....
Quebec	....	20,200	19,000	17,700	20,400
Other	(1)	10,400	10,300	10,100	23,300
Total Canada	....	100,300	91,300	84,100	142,600
Mexico	(1)	(1)	(1)	(1)	(1)
EUROPE.					
Austria-Hungary:					
Austria	4,580,300	5,139,100	5,134,700	5,092,700	4,994,700
Hungary proper	2,460,900	2,575,000	2,485,700	2,634,500	2,690,800
Croatia-Slavonia	171,500	175,100	172,100	221,400	239,700
Bosnia-Herzegovina	37,700	31,100	28,200	30,900	30,300
Total Austria-Hungary	7,250,400	7,920,300	7,820,700	7,979,500	7,955,500
Belgium	641,800	637,900	636,400	(1)	(1)
Bulgaria	450,800	429,300	498,000	561,800	(1)

[1] No official statistics of area.

RYE—Continued.

Rye area of countries named, 1907–1911—Continued.

Country.	1907	1908	1909	1910	1911
EUROPE—continued.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Denmark	682,000	(1)	(1)	(1)	(1)
Finland	(1)	(1)	(1)	(1)	(1)
France	3,064,300	3,074,800	3,031,900	2,994,200	2,923,700
Germany	14,931,500	5,122,600	15,149,300	15,287,500	15,161,100
Italy	(1)	(1)	300,700	300,800	302,200
Netherlands	544,600	548,800	553,400	548,600	555,000
Norway	37,100	(1)	(1)	(1)	(1)
Roumania	362,400	363,400	337,500	429,600	325,700
Russia:					
Russia proper	65,681,900	63,009,500	63,800,500	....	....
Poland	5,238,000	5,130,100	5,204,400	....	....
Northern Caucasia	683,200	553,300	585,500	....	....
Total Russia (European)	71,603,100	68,692,900	69,590,400	68,817,000	....
Servia	109,800	117,800	113,700	102,900	(1)
Spain	2,228,100	2,246,800	2,058,000	2,029,700	1,987,400
Sweden	1,005,900	999,500	998,300	997,500	992,300
United Kingdom	70,100	60,800	63,000	56,900	55,400
ASIA.					
Russia:					
Central Asia	65,200	54,200	189,500	....	....
Siberia	2,609,100	2,265,400	2,201,600	....	....
Transcaucasia	1,200	1,100	1,600	....	....
Total Russia (Asiatic)	2,675,500	2,320,700	2,392,700	2,232,400	....
AUSTRALASIA.					
Australia:					
Queensland	100	100	100	200	100
New South Wales	6,700	5,300	4,700	5,400	4,200
Victoria	1,600	1,400	2,000	2,400	(1)
South Australia	....	....	....	1,500	1,000
Western Australia	600	600	600	1,100	800
Tasmania	700	700	700	1,100	1,300
New Zealand	1,300	3,000	3.500	(1)	4,400
Total Australasia	11,000	11,100	11,600	....	....

[1] No official statistics of area.

Rye crop of countries named, 1907–1911.

Country.	1907	1908	1909	1910	1911
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	31,566,000	31,851,000	29,520,000	34,897,000	33,119,000
Canada:					
Ontario	1,039,000	1,030,000	1,097,000	923,000	1,766,000
Manitoba	84,000	101,000	75,000	92,000	....
Quebec	....	325,000	335,000	308,000	321,000
Other	371,000	255,000	208,000	221,000	607,000
Total Canada	1,494,000	1,711,000	1,715,000	1,544,000	2,694,000
Mexico	70,000	70,000	70,000	70,000	70,000
Total	33,130,000	33,632,000	31,305,000	36,511,000	35,883,000
EUROPE.					
Austria-Hungary:					
Austria	86,452,000	113,309,000	114,433,000	108,938,000	104,123,000
Hungary proper	39,445,000	45,185,000	44,858,000	49,686,000	50,379,000
Croatia-Slavonia	2,136,000	2,520,000	2,393,000	2,318,000	3,793,000
Bosnia-Herzegovina	271,000	298,000	368,000	394,000	379,000
Total Austria-Hungary	128,304,000	161,312,000	162,052,000	161,336,000	157,181,000

RYE—Continued.

Rye crop of countries named, 1907-1911—Continued.

Country.	1907	1908	1909	1910	1911
EUROPE—continued.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Belgium	23,484,000	22,199,000	23,154,000	22,085,000	23,089,000
Bulgaria	3,883,000	5,604,000	6,906,000	9,045,000	10,000,000
Denmark	15,893,000	19,170,000	18,922,000	19,565,000	19,713,000
Finland	11,032,000	11,195,000	12,085,000	11,000,000	11,000,000
France	55,896,000	51,703,000	54,934,000	44,064,000	46,615,000
Germany	384,150,000	422,692,000	446,767,000	413,802,000	427,776,000
Italy	5,000,000	5,000,000	5,032,000	5,439,000	5,297,000
Netherlands	14,483,000	15,866,000	17,652,000	15,126,000	17,410,000
Norway	823,000	869,000	1,011,000	896,000	948,000
Roumania	2,554,000	2,640,000	3,090,000	7,885,000	4,989,000
Russia:					
Russia proper	693,257,000	673,736,000	783,055,000	....	....
Poland	74,127,000	77,954,000	86,775,000	....	....
Northern Caucasia	6,807,000	6,993,000	7,335,000	....	....
Total Russia (European)	774,191,000	758,683,000	877,165,000	843,699,000	742,376,000
Servia	911,000	974,000	1,024,000	768,000	800,000
Spain	27,027,000	26,412,000	34,901,000	27,596,000	28,897,000
Sweden	22,001,000	26,052,000	25,728,000	24,154,000	23,825,000
United Kingdom	1,895,000	1,776,000	1,954,000	1,800,000	1,750,000
Total	1,471,527,000	1,532,147,000	1,692,377,000	1,608,260,000	1,521,666,000
ASIA.					
Russia:					
Central Asia	993,000	564,000	1,498,000	....	....
Siberia	32,931,000	22,775,000	18,152,000	....	....
Transcaucasia	12,000	9,000	18,000	....	....
Total Russia (Asiatic)	33,936,000	23,348,000	19,668,000	23,927,000	19,733,000
AUSTRALASIA.					
Australia:					
Queensland	3,000	1,000	1,000	3,000	2,000
New South Wales	98,000	56,000	51,000	66,000	59,000
Victoria	21,000	22,000	33,000	27,000	30,000
South Australia	....	....	....	15,000	8,000
Western Australia	5,000	5,000	4,000	10,000	6,000
Tasmania	15,000	15,000	18,000	18,000	24,000
Total Australia	142,000	99,000	107,000	139,000	129,000
New Zealand	43,000	73,000	94,000	100,000	109,000
Total Australasia	185,000	172,000	201,000	239,000	238,000
Grand total	1,538,778,000	1,589,299,000	1,742,466,000	1,668,937,000	1,577,520,000

Average yield of rye in countries named, bushels per acre, 1890-1911.

Year.	United States.	Russia, European.[1]	Germany.[1]	Austria.[1]	Hungary proper.[1]	France.[2]	Ireland.[1]
Average (1890-1899)	13.9	10.4	20.9	16.1	....	17.6	25.2
Average (1900-1909)	15.7	11.5	25.6	19.0	17.6	17.1	27.5
1902	17.0	12.5	24.6	18.2	19.1	14.3	28.1
1903	15.4	12.2	26.2	18.2	18.6	18.1	26.9
1904	15.2	13.7	26.3	19.3	17.0	16.6	26.0
1905	16.5	10.1	24.9	20.2	19.4	18.5	27.0
1906	16.7	8.8	25.1	19.9	19.8	16.3	27.6
1907	16.4	10.8	25.8	18.9	16.0	18.2	27.0
1908	16.4	11.0	28.0	22.0	17.5	16.8	29.2
1909	13.4	12.6	28.8	22.3	17.8	18.1	30.8
1910	16.0	12.3	27.1	21.4	18.9	14.7	30.3
1911	15.6	....	28.3	20.8	18.7	16.5	28.9
Average (1902-1911)	15.9	....	26.5	20.1	18.3	16.8	28.2

[1] Bushels of 56 pounds. [2] Winchester bushels.

RYE—Continued.

Acreage, production, value, prices, and exports of rye in the United States, 1849–1911.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, including rye flour, fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*
1849 [1]	......	......	*14,189,000*	......	......	......	......	......	......	......
1859 [1]	......	......	*21,101,000*	......	......	......	......	......	......	......
1866	1,548,000	13.5	20,865,000	82.2	17,150,000	......	......	142	150	234,971
1867	1,689,000	13.7	23,184,000	100.4	23,281,000	132	157	173	185	564,901
1868	1,651,000	13.6	22,505,000	94.9	21,349,000	106½	118	100	115½	92,869
1869	1,658,000	13.6	22,528,000	77.0	17,342,000	66	77½	78	83½	199,450
1869 [1]	......	......	*16,919,000*	......	......	......	......	......	......	......
1870	1,176,000	13.2	15,474,000	73.2	11,327,000	67	74	81	91	87,174
1871	1,070,000	14.4	15,366,000	71.1	10,928,000	62	63¾	75	93	832,689
1872	1,049,000	14.2	14,889,000	67.6	10,071,000	57½	70	68½	70	611,749
1873	1,150,000	13.2	15,142,000	70.3	10,638,000	70	81	91	102	1,923,404
1874	1,117,000	13.4	14,991,000	77.4	11,610,000	93	99½	103	107½	267,058
1875	1,360,000	13.0	17,722,000	67.1	11,894,000	67	68¾	61½	70½	589,159
1876	1,468,000	13.9	20,375,000	61.4	12,505,000	65½	73	70	92½	2,234,856
1877	1,413,000	15.0	21,170,000	57.6	12,202,000	55½	56½	54	60	4,249,684
1878	1,623,000	15.9	25,843,000	52.5	13,566,000	44	44½	47	52	4,877,821
1879	1,625,000	14.5	23,639,000	65.6	15,507,000	73½	81	73½	85	2,943,894
1879 [1]	*1,842,000*	*10.8*	*19,832,000*	......	......	......	......	......	......	......
1880	1,768,000	13.9	24,541,000	75.6	18,565,000	82	91½	115	118	1,955,155
1881	1,789,000	11.6	20,705,000	93.3	19,327,000	96½	98	77	83	1,003,609
1882	2,228,000	13.4	29,960,000	61.5	18,439,000	57	58½	62	67	2,206,212
1883	2,315,000	12.1	28,059,000	58.1	16,301,000	56½	60	60½	62½	6,247,590
1884	2,344,000	12.2	28,640,000	51.9	14,857,000	51	52	68	73	2,974,390
1885	2,129,000	10.2	21,756,000	57.9	12,595,000	58½	61	58	61	216,699
1886	2,130,000	11.5	24,489,000	53.8	13,181,000	53	54½	54½	56½	377,302
1887	2,053,000	10.1	20,693,000	54.5	11,283,000	55½	61½	63	68	94,827
1888	2,365,000	12.0	28,415,000	58.8	16,722,000	50	52	39	41½	309,266
1889	2,171,000	13.1	28,420,000	42.3	12,010,000	44	45½	49½	54	2,280,975
1889 [1]	*2,172,000*	*13.1*	*28,421,000*	......	......	......	......	......	......	......
1890	2,142,000	12.0	25,807,000	62.9	16,230,000	64½	68½	83	92	358,263
1891	2,176,000	14.6	31,752,000	77.4	24,589,000	86	92	70¼	79	12,068,628
1892	2,164,000	12.9	27,979,000	54.2	15,160,000	46	51	50½	62	1,493,924
1893	2,038,000	13.0	26,555,000	51.3	13,612,000	45	47½	44½	48	249,152
1894	1,945,000	13.7	26,728,000	50.1	13,395,000	47½	49	62½	67	32,045
1895	1,890,000	14.4	27,210,000	44.0	11,965,000	32	35¾	33	36½	1,011,128
1896	1,831,000	13.3	24,369,000	40.9	9,961,000	37	42½	32¾	35½	8,575,663
1897	1,704,000	16.1	27,363,000	44.7	12,240,000	45¾	47	48	75	15,562,035
1898	1,643,000	15.6	25,658,000	46.3	11,875,000	52½	55½	56½	62	10,169,822
1899	1,659,000	14.4	23,962,000	51.0	12,214,000	49	52	53	56¼	2,382,012
1899 [1]	*2,054,000*	*12.4*	*25,569,000*	......	......	......	......	......	......	......
1900	1,591,000	15.1	23,996,000	51.2	12,295,000	45¾	49¾	51½	54	2,345,512
1901	1,988,000	15.3	30,345,000	55.7	16,910,000	59	65¾	54½	58	2,712,077
1902	1,979,000	17.0	33,631,000	50.8	17,081,000	48	49¾	48	50½	5,445,273
1903	1,907,000	15.4	29,363,000	54.5	15,994,000	50½	52½	69¾	78	784,068
1904	1,793,000	15.2	27,242,000	68.8	18,748,000	73	75	70	84	29,749
1905	1,730,000	16.5	28,486,000	61.1	17,414,000	64	68	58	62	1,387,826
1906	2,002,000	16.7	33,375,000	58.9	19,671,000	61	65	69	87½	769,717
1907	1,926,000	16.4	31,566,000	73.1	23,068,000	75	82	79	86	2,444,588
1908	1,948,000	16.4	31,851,000	73.6	23,455,000	75	77¼	83	90	1,295,701
1909	2,006,000	16.1	32,239,000	73.9	23,809,000	72	80	74	80	242,262
1909 [1]	*2,196,000*	*13.4*	*29,520,000*	......	......	......	......	......	......	......
1910 [2]	2,185,000	16.0	34,897,000	71.5	24,953,000	80	82	90	113	40,123
1911 [2]	2,127,000	15.6	33,119,000	83.2	27,557,000	91	94	......	......	......

[1] Census figures.

[2] Figures adjusted to census basis.

RYE—Continued.

Acreage, production, and value of rye in the United States in 1911.

State and Division.	Acreage.	Production.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Dollars.*
Vermont	1,000	22,000	21,000
Massachusetts	3,000	48,000	46,000
Connecticut	8,000	148,000	138,000
New York	135,000	2,254,000	2,006,000
New Jersey	72,000	1,181,000	980,000
Pennsylvania	285,000	4,304,000	3,443,000
N. Atlantic	504,000	7,957,000	6,634,000
Delaware	1,000	15,000	14,000
Maryland	28,000	406,000	349,000
Virginia	48,000	552,000	491,000
West Virginia	17,000	187,000	168,000
North Carolina	47,000	470,000	470,000
South Carolina	3,000	30,000	44,000
Georgia	12,000	114,000	157,000
S. Atlantic	156,000	1,774,000	1,693,000
Ohio	60,000	930,000	790,000
Indiana	73,000	1,000,000	800,000
Illinois	52,000	874,000	708,000
Michigan	400,000	5,840,000	4,964,000
Wisconsin	355,000	6,035,000	5,069,000
N. Central E. of Miss. R	940,000	14,679,000	12,331,000
Minnesota	240,000	4,488,000	3,501,000
Iowa	30,000	540,000	416,000
Missouri	16,000	226,000	190,000
North Dakota	36,000	598,000	454,000
South Dakota	13,000	130,000	99,000
Nebraska	52,000	676,000	507,000
Kansas	18,000	198,000	160,000
N. Central W. of Miss. R	405,000	6,856,000	5,327,000
Kentucky	22,000	264,000	248,000
Tennessee	19,000	226,000	224,000
Alabama	1,000	10,000	12,000
Texas	2,000	20,000	21,000
Oklahoma	4,000	38,000	40,000
Arkansas	1,000	10,000	9,000
S. Central	49,000	568,000	554,000
Montana	8,000	184,000	132,000
Wyoming	2,000	40,000	36,000
Colorado	21,000	252,000	176,000
Utah	5,000	78,000	55,000
Idaho	3,000	68,000	46,000
Washington	8,000	176,000	141,000
Oregon	18,000	351,000	316,000
California	8,000	136,000	116,000
Far Western	73,000	1,285,000	1,018,000
United States	2,127,000	33,119,000	27,557,000

Condition of the rye crop in the United States on the first of months named, 1888–1912.

Year.	December of previous year.	April.	May.	June.	July.	August.	When harvested.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1888	96.0	93.5	92.9	93.9	95.1	91.4	92.8
1889	97.2	93.9	96.5	95.2	96.7	95.4	91.6
1890	96.4	92.8	93.5	92.3	92.0	86.8	85.4
1891	99.0	95.4	97.2	95.4	93.9	89.6	95.1
1892	88.8	87.0	88.9	91.0	92.8	89.8	88.5
1893	89.4	85.7	82.7	84.6	85.3	78.5	82.0
1894	94.6	94.4	90.7	93.2	87.0	79.8	86.9
1895	96.2	87.0	88.7	85.7	80.7	84.0	83.7
1896	88.1	82.9	87.7	85.2	88.4	88.0	82.0
1897	99.8	88.9	88.0	89.9	93.4	89.8	90.1
1898	91.0	92.1	94.5	97.1	94.6	93.7	89.4
1899	98.9	84.9	85.2	84.5	84.9	89.0	82.0
1900	98.2	84.8	88.5	87.6	84.0	76.0	84.2
1901	99.1	93.1	94.6	93.9	93.5	83.6	84.9
1902	89.9	85.4	83.4	88.1	91.2	90.5	90.2
1903	98.1	97.9	93.3	90.6	90.2	87.2	84.1
1904	92.7	82.3	81.2	86.3	89.0	91.8	86.9
1905	90.5	92.1	93.5	93.6	92.9	92.6	90.8
1906	95.4	90.9	92.9	89.9	91.3	90.8	90.5
1907	96.2	92.0	88.0	88.1	89.7	88.9	....
1908	91.4	89.1	90.3	91.3	91.2	88.3	....
1909	87.6	87.2	88.1	89.6	91.4	89.1	....
1910	94.1	92.3	82.1	90.6	87.5	....	....
1911	92.6	89.3	90.0	88.6	85.0	....	....
1912	93.3	....	....	....	....	....	....

RYE—Continued.

Average yield per acre and farm price per bushel of rye in the United States.

State and Division.	Yield per acre.						Farm price per bushel.								
	10-year averages.				1910	1911	10-year averages for Dec. 1.				Dec. 1, 1910.	Quarterly, 1911.			
	1870–1879	1880–1889	1890–1899	1900–1909			1870–1879	1880–1889	1890–1899	1900–1909		Mar. 1.	June 1.	Sept. 1.	Dec. 1.
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
Vermont	16.8	14.3	15.7	16.8	17.5	22.5	90	79	69	75	85	....	....	....	95
Massachusetts	15.6	13.9	17.3	15.8	17.0	16.0	89	83	74	82	94	97	85	95	95
Connecticut	14.6	13.5	15.7	17.6	20.0	18.5	95	78	68	76	86	73	82	86	93
New York	13.8	12.0	15.5	16.1	18.3	16.7	76	69	59	68	74	75	79	82	89
New Jersey	13.4	10.9	14.2	16.4	18.0	16.4	77	70	60	67	77	72	73	76	83
Pennsylvania	13.8	10.6	15.0	16.1	17.0	15.1	75	67	56	66	73	72	76	76	80
North Atlantic	13.9	11.3	14.9	16.2	17.5	15.8	77.4	69.6	59.5	67.1	74.3	73.1	76.6	78.0	83.4
Delaware	11.7	8.3	8.2	14.0	15.5	15.0	71	65	68	69	69	70	75	69	95
Maryland	12.2	10.4	12.8	14.8	16.1	14.5	70	67	57	66	75	68	73	74	86
Virginia	10.4	6.9	9.4	12.3	13.5	11.5	63	68	57	71	80	78	78	84	89
West Virginia	12.7	8.4	10.5	11.7	12.9	11.0	72	70	62	74	90	78	76	78	90
North Carolina	9.2	5.7	7.6	9.4	10.0	10.0	77	83	72	88	101	92	94	94	100
South Carolina	6.5	4.6	6.2	8.4	10.0	10.0	133	109	100	121	146	154	166	130	145
Georgia	7.6	5.4	6.7	8.0	10.4	9.5	138	109	100	115	140	140	147	146	138
South Atlantic	10.0	6.8	9.1	11.3	12.5	11.4	56.2	77.0	66.0	79.4	89.7	83.5	85.5	87.6	95.4
Ohio	13.6	12.4	14.9	17.1	16.5	15.5	66	62	52	64	72	71	75	75	85
Indiana	14.2	11.5	14.1	15.2	15.8	13.7	63	61	49	61	68	70	71	74	80
Illinois	16.8	15.2	15.1	17.6	17.4	16.8	52	56	48	61	71	68	78	75	81
Michigan	14.8	12.3	13.5	15.1	15.3	14.6	65	62	49	60	68	71	78	77	85
Wisconsin	15.5	13.6	14.8	17.0	16.0	17.0	56	56	47	60	71	73	83	76	84
N. C. E. Miss. R.	15.7	14.2	14.6	16.3	15.8	15.6	74.3	57.1	48.1	60.3	69.6	71.4	79.2	76.1	84.0
Minnesota	18.6	14.9	17.4	19.1	17.0	18.7	50	50	42	54	64	69	80	75	78
Iowa	17.4	13.2	16.6	18.0	18.5	18.0	45	48	43	53	64	66	71	74	77
Missouri	15.4	11.9	12.9	14.8	15.0	14.1	56	55	50	64	75	73	73	84	84
North Dakota	....	14.4	14.6	16.4	8.5	16.6	....	49	38	51	63	64	77	69	76
South Dakota	....	14.3	12.3	17.0	17.0	10.0	....	49	38	49	61	65	80	68	76
Nebraska	17.6	13.7	13.8	16.8	16.0	13.0	44	41	39	49	60	60	66	72	75
Kansas	18.0	14.4	10.9	14.2	14.0	11.0	50	43	44	57	73	69	69	78	81
N. C. W. Miss. R.	17.4	13.8	13.9	17.0	16.2	16.9	47.3	46.1	42.0	52.3	64.1	66.2	74.3	73.9	77.7
Kentucky	11.7	9.2	11.7	13.6	13.0	12.0	68	68	62	74	85	79	87	85	94
Tennessee	9.9	6.3	8.6	11.7	11.0	11.9	78	84	65	79	92	90	92	93	99
Alabama	9.8	5.7	9.1	10.3	12.0	10.0	130	110	101	114	120	155	121	140	125
Texas	16.0	10.4	9.5	13.0	11.5	10.0	103	86	74	89	103	112	....	106	107
Oklahoma	....	....	....	13.5	13.7	9.5	....	....	....	66	81	75	79	106	104
Arkansas	12.8	7.3	9.4	10.8	12.0	10.0	105	88	72	87	98	....	100	....	90
South Central	11.4	8.2	10.4	12.6	12.2	11.6	72.8	73.1	65.0	78.8	88.4	80.8	86.2	92.2	97.5
Montana	....	....	....	23.1	20.0	23.0	....	....	....	67	68	67	80	57	72
Wyoming	....	....	....	21.2	18.5	20.0	....	....	....	67	81	....	....	....	90
Colorado	[1] 24.2	16.8	17.1	18.3	14.0	12.0	[1] 98	74	56	62	67	63	64	82	70
Utah	....	10.7	16.3	17.6	18.5	15.5	....	62	52	64	68	74	73	65	70
Idaho	....	12.5	13.0	21.1	20.0	22.5	....	62	63	65	66	63	58	73	67
Washington	....	14.7	17.0	19.2	20.5	22.0	....	72	64	73	89	75	115	81	80
Oregon	22.3	15.5	12.9	15.7	15.1	19.5	84	73	65	81	100	99	99	85	90
California	20.0	10.5	13.5	12.8	17.0	17.0	104	79	68	77	86	75	80	73	85
Far Western	19.9	11.4	14.0	14.2	16.5	17.6	99.0	76.2	64.7	75.2	79.5	75.9	81.6	74.0	79.2
United States	14.1	12.0	14.0	16.0	16.0	15.6	66.4	60.8	52.3	62.2	71.5	71.9	77.9	76.9	83.2

[1] The Territories.

RYE—Continued.

Wholesale prices of rye per bushel, 1898–1911.

Date.	Philadelphia.		Cincinnati.		Chicago.		Duluth.		San Francisco (per 100 lbs.).	
			No. 2.		No. 2.					
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Dolls.*	*Dolls.*
1898	......	......	40	80	41	75	40½	72	......	......
1899	......	......	56	68	49	62	47	59½	......	......
1900	......	......	51½	67	44½	60½	46	60½	......	......
1901	58	71½	45	73	46¾	65¾	46½	62½	0.75	0.87½
1902	54	71	51	71½	48	67½	46	64	.77½	1.15
1903	56	68½	54	63	48	60	48	55¼	1.10	1.30
1904	65	96	61	87	51	81	54½	80	1.25	1.47½
1905	63	90¼	56	87	57½	84	55½	78	1.40	1.75
1906	55½	67	58	72½	55½	68	53	61	......	......
1907	75	100	68	93	60	91¼	57	86	1.35	1.52½
1908.										
January	93	95	81	89	79	87	71	78	1.45	1.52½
February	93	95	85	89	80	85	74	78	1.47½	1.52½
March	94	95	85	89	74	85	69	80	1.47½	1.52½
April	94	95	82	84	74	81	69	74	1.43¾	1.50
May	92	94	82	86	79	86	71	76	1.43¾	1.50
June	90	92	84	86	72	80	66	76	1.45	1.52½
July	90	92	78	86	72	80	60	73	1.45	1.50
August	80	85	78	81	75	78¾	71½	75	1.35	1.45
September	80	85	78	80	75½	77	71	74	1.40	1.45
October	81	86	78	82	74	76½	68½	74	1.40	1.47½
November	82	86	78	80	73	76	67	71	1.45	1.50
December	82	86	78	80	75	77¼	67	72	1.42½	1.50
Year	80	95	78	89	72	87	60	80	1.35	1.52½
1909.										
January	90	95	78	82	74	77½	67	71	1.55	1.70
February	90	95	80	82	75½	79½	67	74	1.65	1.85
March	88	95	81	84	79	81	71	75	1.75	1.85
April	87	88	82	90	80	87	72	83	......	......
May	85	87	88	92	83	90	80	88	......	......
June	85	87	90	92	81	91	72	88	......	......
July	75	80	75	90	74	83½	69	76	......	......
August	75	82	70	85	67	76½	62	72	1.70	1.80
September	82	85	70	77½	70	74	62	67	1.80	1.85
October	85	86	75	78	71	75	64	71	......	......
November	85	86	76	80	73	77	67	71	2.00	2.05
December	86	87	77	81	72	80	68	74	......	......
Year	75	95	70	92	67	91	62	88	1.55	2.05
1910.										
January	90	92	79	87	79	82	71½	78½	Nominal.	
February	90	92	84	86	80	82	75	78½	1.97½	2.00
March	87	89	83	86½	78	80	72	78	1.97½	2.00
April	85	87	82	86	77½	80½	70	75	1.85	1.95
May	83	85	81	84	74	80	68	73	1.70	1.85
June	83	85	80	83	74	77	67	70	1.55	1.75
July	75	77	78	83	74	80	67	70	1.55	1.70
August	77	78	73	80	72	78	67	75	1.60	1.70
September	78	80	73	77	72½	74½	68	70	1.60	1.70
October	80	81	75	81	74½	77½	68	74	1.50	1.65
November	80	81	80	85	77	80½	71½	75	1.50	1.55
December	81	85½	83	87	80	82	71½	76	1.50	1.60
Year	75	92	73	87	72	82	67	78½	1.50	2.00
1911.										
January	88	90	85	88	81	86	74	79	1.50	1.60
February	78	80	85	88	80	84	74	78	1.50	1.60
March	79	82	86	96½	85	93	77	84	1.40	1.60
April	82	85	90	98	90	100	82	88	1.40	1.50
May	85	90	95	115	90	113	86	100	1.42½	1.50
June	90	91	88	97	87	93	81	88	1.45	1.60
July	91	92	79	90	80½	87	72	83	1.50	1.60
August	92	92	81	92	82½	87½	76	84	1.50	1.60
September	92	107	90	101	85½	96½	79½	91½	1.47½	1.52½
October	100	107	98	100	95½	98	89½	93½	1.47½	1.57½
November	100	106	94	100	90	100	83	92	1.50	1.57½
December	100	105	94	98	91	94	83½	88	1.50	1.57½
Year	78	107	79	101	80	113	72	100	1.40	1.60

RYE—Continued.

Average farm price of rye per bushel on the first of each month, 1910–1911.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	73.3	74.8	76.1	79.5	87.1	92.1	71.7	72.6	66.8	64.8	85.0	95.4	76.1	91.5
February	73.1	76.1	74.5	81.1	85.8	92.8	72.3	73.6	67.8	66.0	83.2	99.2	74.6	91.9
March	71.9	76.5	73.1	82.6	83.5	93.8	71.4	74.0	66.2	67.2	80.8	91.8	75.9	85.3
April	75.4	76.6	74.5	83.5	83.8	95.9	75.1	73.6	68.2	66.0	82.5	94.8	98.6	88.9
May	75.8	74.9	75.1	82.0	83.9	92.2	77.4	71.6	70.2	65.5	81.8	94.0	78.0	83.1
June	77.9	74.8	76.6	81.5	85.5	91.8	79.2	71.4	74.3	64.1	86.2	87.4	81.6	87.9
July	76.9	74.6	77.9	81.5	87.2	91.4	76.7	71.9	72.4	64.5	84.5	88.8	76.5	82.5
August	75.5	74.4	79.1	80.2	86.5	89.5	71.9	71.9	70.3	64.9	87.0	92.6	85.5	85.7
September	76.9	74.1	78.0	80.1	87.6	91.8	76.1	70.7	73.9	66.3	92.2	91.8	74.0	82.2
October	79.7	72.8	80.4	78.5	86.5	91.9	80.2	69.5	76.4	64.8	95.2	92.2	74.1	82.9
November	83.1	71.6	81.7	75.7	93.4	93.4	85.9	69.5	78.5	63.2	99.5	91.2	75.0	81.9
December	83.2	72.2	83.4	74.2	95.4	92.8	84.0	69.7	77.7	64.1	97.5	91.1	79.2	84.8

BUCKWHEAT.

Acreage, production, and value of buckwheat in the United States, 1849–1911.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
1849 [1]			*8,957,000*		
1859 [1]			*17,572,000*		
1866	1,046,000	21.8	22,792,000	67.6	15,413,000
1867	1,228,000	17.4	21,359,000	78.7	16,812,000
1868	1,114,000	17.8	19,864,000	78.0	15,490,000
1869	1,029,000	16.9	17,431,000	71.9	12,535,000
1869 [1]			*9,822,000*		
1870	537,000	18.3	9,842,000	70.5	6,937,000
1871	414,000	20.1	8,329,000	74.5	6,208,000
1872	448,000	18.1	8,134,000	73.5	5,979,000
1873	454,000	17.3	7,838,000	75.0	5,879,000
1874	453,000	17.7	8,017,000	72.9	5,844,000
1875	576,000	17.5	10,082,000	62.0	6,255,000
1876	666,000	14.5	9,669,000	66.6	6,436,000
1877	650,000	15.7	10,177,000	66.9	6,808,000
1878	673,000	18.2	12,247,000	52.6	6,441,000
1879	640,000	20.5	13,140,000	59.8	7,856,000
1879 [1]	*848,000*	*13.9*	*11,817,000*		
1880	823,000	17.8	14,618,000	59.4	8,682,000
1881	829,000	11.4	9,486,000	86.5	8,206,000
1882	847,000	13.0	11,019,000	73.0	8,039,000
1883	857,000	8.9	7,669,000	82.2	6,304,000
1884	879,000	12.6	11,116,000	58.9	6,549,000
1885	914,000	13.8	12,626,000	55.9	7,057,000
1886	918,000	12.9	11,869,000	54.5	6,465,000
1887	911,000	11.9	10,844,000	56.5	6,122,000
1888	913,000	13.2	12,050,000	63.3	7,628,000
1889	837,000	14.5	12,110,000	50.5	6,113,000
1889 [1]	*837,000*	*14.5*	*12,110,000*		
1890	845,000	14.7	12,433,000	57.4	7,133,000
1891	849,000	15.0	12,761,000	57.0	7,272,000
1892	861,000	14.1	12,143,000	51.8	6,296,000
1893	816,000	14.9	12,132,000	58.3	7,074,000
1894	789,000	16.1	12,668,000	55.6	7,040,000
1895	763,000	20.1	15,341,000	45.2	6,936,000
1896	755,000	18.7	14,090,000	39.2	5,522,000
1897	718,000	20.9	14,997,000	42.1	6,319,000
1898	678,000	17.3	11,722,000	45.0	5,271,000

[1] Census figures.

BUCKWHEAT—Continued.

Acreage, production, and value of buckwheat in the United States, 1849–1911—Continued.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
1899	670,000	16.6	11,094,000	55.7	6,184,000
1899 [1]	*807,000*	*13.9*	*11,234,000*		
1900	638,000	15.0	9,567,000	55.8	5,341,000
1901	811,000	18.6	15,126,000	56.3	8,523,000
1902	805,000	18.1	14,530,000	59.6	8,655,000
1903	804,000	17.7	14,244,000	60.7	8,651,000
1904	794,000	18.9	15,008,000	62.2	9,331,000
1905	760,000	19.2	14,585,000	58.7	8,565,000
1906	789,000	18.6	14,642,000	59.6	8,727,000
1907	800,000	17.9	14,290,000	69.8	9,975,000
1908	803,000	19.8	15,874,000	75.6	12,004,000
1909	834,000	20.9	17,438,000	69.9	12,188,000
1909 [1]	*878,000*	*16.9*	*14,849,000*		
1910 [2]	860,000	20.5	17,598,000	66.1	11,636,000
1911 [2]	833,000	21.1	17,549,000	72.6	12,735,000

[1] Census figures. [2] Figures adjusted to census basis.

Acreage, production, and value of buckwheat in the United States in 1911.

State and Division.	Acreage sown and harvested.	Production.	Farm value Dec. 1.	State and Division.	Acreage.	Production.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Dollars.*		*Acres.*	*Bushels.*	*Dollars.*
Maine	15,000	450,000	315,000	Michigan	67,000	1,206,000	856,000
New Hampshire	1,000	27,000	22,000	Wisconsin	18,000	315,000	236,000
Vermont	8,000	194,000	165,000				
Massachusetts	2,000	42,000	37,000				
Connecticut	3,000	57,000	54,000	N. C. E. of Miss. R.	113,000	2,084,000	1,539,000
New York	280,000	5,964,000	4,354,000				
New Jersey	13,000	260,000	195,000	Minnesota	7,000	126,000	96,000
Pennsylvania	291,000	6,373,000	4,397,000	Iowa	7,000	122,000	110,000
				Missouri	2,000	20,000	21,000
N. Atlantic	613,000	13,367,000	9,539,000	Nebraska	1,000	16,000	15,000
				Kansas	1,000	12,000	12,000
Delaware	4,000	76,000	49,000				
Maryland	12,000	240,000	161,000				
Virginia	24,000	384,000	269,000	N. C. W. of Miss. R.	18,000	296,000	254,000
West Virginia	36,000	864,000	734,000				
North Carolina	10,000	190,000	152,000	Tennessee	3,000	48,000	38,000
S. Atlantic	86,000	1,754,000	1,365,000	S. Central	3,000	48,000	38,000
Ohio	19,000	399,000	311,000				
Indiana	5,000	92,000	68,000	United States	833,000	17,549,000	12,735,000
Illinois	4,000	72,000	68,000				

Condition of the buckwheat crop in the United States on first of months named, 1891–1911.

Year.	Aug.	Sept.	When harvested.	Year.	Aug.	Sept.	When harvested.	Year.	Aug.	Sept.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*
1891	97.3	96.6	92.7	1898	87.2	88.8	76.2	1905	92.6	91.8	91.6
1892	92.9	89.0	85.6	1899	93.2	75.2	70.2	1906	93.2	91.2	84.9
1893	88.8	77.5	73.5	1900	87.9	80.5	72.8	1907	91.9	77.4	80.1
1894	82.3	69.2	72.0	1901	91.1	90.9	90.5	1908	89.4	87.8	81.6
1895	85.2	87.5	84.8	1902	91.4	86.4	80.5	1909	86.4	81.1	79.5
1896	96.0	93.2	86.0	1903	93.9	91.0	83.0	1910	87.9	82.3	81.7
1897	94.9	95.1	90.8	1904	92.8	91.5	88.7	1911	82.9	83.8	81.4

BUCKWHEAT—Continued.

Average farm price of buckwheat per bushel on the first of each month, 1910–1911.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	65.8	70.0	65.1	68.7	69.8	81.2	65.2	72.8	95.2	80.5	77.0	88.0	......	......
February	64.4	72.0	63.4	71.1	71.4	79.6	65.1	73.9	79.5	78.5	77.0	88.0	......	......
March	64.1	70.6	62.9	69.5	69.4	80.5	66.3	72.7	87.8	79.5	71.0	......	......	......
April	65.3	73.4	64.1	72.9	73.2	78.8	67.3	73.5	89.5	83.0	70.0	85.0	......	......
May	65.8	71.0	64.7	70.0	70.4	81.1	68.5	71.7	89.2	83.5	75.0	79.0	......	......
June	70.1	73.7	69.3	72.5	71.9	82.9	74.6	76.9	81.4	83.5	76.0	80.0	......	......
July	72.4	78.0	72.1	77.3	72.2	82.7	74.0	80.0	82.2	90.5	76.0	82.0	......	......
August	76.0	74.8	76.5	74.2	72.9	80.8	70.2	75.3	102.1	86.0	78.0	82.0	......	......
September	74.0	72.6	74.0	71.6	75.5	79.9	72.0	74.4	76.9	90.5	80.0	......	......	......
October	69.6	71.3	69.3	70.3	71.0	77.7	69.4	72.8	79.6	90.0	81.0	......	......	......
November	73.0	65.9	73.0	64.3	71.6	76.2	72.5	72.6	82.6	72.5	75.0	90.0	......	......
December	72.6	65.7	71.4	64.3	77.8	75.5	73.8	68.0	85.8	82.1	79.0	86.0	......	......

Average yield per acre and farm price per bushel of buckwheat in the United States.

State and Division.	Yield per acre.						Farm price per bushel.								
	10-year averages.				1910	1911	10-year averages for Dec. 1.				Dec. 1, 1910.	Quarterly, 1911.			
	1870–1879	1880–1889	1890–1899	1900–1909			1870–1879	1880–1889	1890–1899	1900–1909		Mar. 1.	June 1.	Sept. 1.	Dec. 1.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Maine	23.2	18.4	29.2	29.8	32.5	30.0	63	56	50	59	68	67	74	67	70
New Hampshire	19.0	18.1	22.4	21.8	31.0	27.3	62	61	56	67	62	55	.....	90	81
Vermont	21.5	18.4	24.8	23.1	24.0	24.3	61	59	49	60	70	85	82	80	85
Massachusetts	13.6	14.1	18.4	17.8	22.0	21.0	73	70	66	71	85	90	90	110	89
Connecticut	16.5	12.1	16.0	17.3	19.5	19.0	83	69	63	75	83	81	85	92	95
New York	18.4	13.7	17.0	18.8	23.0	21.3	66	62	50	63	65	63	70	76	73
New Jersey	17.6	11.6	16.7	19.4	21.5	20.0	76	71	56	65	69	66	68	82	75
Pennsylvania	18.7	13.1	16.9	18.3	19.5	21.9	70	66	50	62	62	61	67	71	69
N. Atlantic	18.6	13.7	17.7	19.1	21.6	21.8	67.8	63.3	50.3	62.4	64.1	62.9	69.3	74.0	71.4
Delaware	19.6	12.9	16.7	18.1	20.5	19.0	75	65	50	60	65	.....	.....	50	65
Maryland	17.4	13.0	14.7	17.5	18.5	20.0	70	68	57	64	66	76	71	84	67
Virginia	15.3	10.7	13.2	17.3	18.0	16.0	61	65	55	64	77	66	65	68	70
West Virginia	17.1	10.1	17.1	19.3	23.0	24.0	69	67	58	68	77	73	76	79	85
North Carolina	15.2	9.5	13.9	15.1	19.0	19.0	56	63	52	68	80	79	76	80	80
S. Atlantic	16.6	10.7	15.6	17.9	20.4	20.4	66.4	66.2	57.1	65.8	75.5	69.4	71.9	75.5	77.8
Ohio	14.1	11.1	15.4	17.5	18.0	21.0	77	73	57	67	75	70	80	70	78
Indiana	16.1	10.4	14.8	16.0	17.7	18.3	69	73	57	68	70	55	55	71	74
Illinois	14.6	10.6	13.2	16.3	20.0	18.1	72	72	58	75	90	88	87	98	95
Michigan	16.0	13.2	14.4	14.4	15.3	18.0	62	65	48	58	62	64	74	70	71
Wisconsin	15.8	10.6	14.2	14.9	14.0	17.5	59	63	49	64	75	68	74	73	75
N. C. E. Miss R.	15.4	11.4	14.4	15.2	15.9	18.4	65.2	66.9	50.3	62.6	68.3	66.3	74.6	72.0	73.8
Minnesota	16.2	11.0	13.8	15.0	16.0	18.0	65	64	50	62	72	78	72	63	76
Iowa	17.6	11.2	14.4	14.5	14.9	17.5	67	69	57	73	83	90	82	78	90
Missouri	17.9	11.4	13.6	15.4	16.5	10.0	62	68	63	78	87	98	98	85	105
Nebraska	19.7	10.1	12.1	15.3	20.0	16.0	73	71	59	72	90	80	.....	100	95
Kansas	16.3	11.1	10.4	13.9	15.0	12.0	82	74	75	80	90	105	.....	.....	98
N. C. W. Miss. R.	17.1	11.0	13.6	14.6	15.8	16.4	69.3	68.4	55.6	70.5	80.0	87.8	81.4	76.9	85.8
Tennessee	14.2	8.4	14.0	15.4	15.0	16.0	75	66	57	72	86	71	76	80	79
S. Central	14.0	8.7	14.2	15.4	15.0	16.0	75.0	66.3	57.1	72.1	86.0	71.0	76.0	80.0	79.0
United States	17.8	13.0	16.8	18.5	20.5	21.1	67.4	64.1	50.7	62.8	66.1	64.1	70.1	74.0	72.6

POTATOES.

Potato crop of countries named, 1906–1910.

[No statistics for Portugal, Egypt, and some other less important potato-growing countries.]

Country.	1906	1907	1908	1909	1910
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States (contiguous)	308,038,000	298,262,000	278,985,000	389,195,000	349,032,000
Canada:					
Prince Edward Island	(1)	5,453,000	7,327,000	6,761,000	4,915,000
Nova Scotia	(1)	8,294,000	7,884,000	9,098,000	6,432,000
New Brunswick	5,522,000	5,183,000	11,203,000	12,247,000	7,486,000
Quebec	(1)	22,911,000	16,680,000	30,853,000	21,271,000
Ontario	15,494,000	20,908,000	23,096,000	29,465,000	26,163,000
Manitoba	4,281,000	4,150,000	3,807,000	4,118,000	2,838,000
Saskatchewan	5,507,000	2,706,000	1,826,000	3,944,000	2,658,000
Alberta		2,632,000	1,967,000	2,599,000	2,285,000
Other	[2] 29,000,000	....	....	....	....
Total Canada	59,804,000	72,237,000	73,790,000	99,085,000	74,048,000
Mexico	924,000	[3] 924,000	[3] 924,000	[3] 924,000	[3] 924,000
Newfoundland [2]	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000
Total	370,116,000	372,773,000	355,049,000	490,554,000	425,354,000
SOUTH AMERICA.					
Argentina	[4] 10,000,000	[4] 10,000,000	[5] 10,000,000	[4] 10,000,000	[4] 10,000,000
Chile	[6] 6,532,000	[6] 6,532,000	8,063,000	6,404,000	7,863,000
Total	16,532,000	16,532,000	18,063,000	16,404,000	17,863,000
EUROPE.					
Austria-Hungary:					
Austria	514,289,000	538,789,000	475,860,000	479,616,000	491,126,000
Hungary proper	179,083,000	178,168,000	139,469,000	183,530,000	176,974,000
Croatia-Slavonia	12,854,000	25,625,000	21,129,000	16,832,000	[7] 16,832,000
Bosnia-Herzegovina	2,328,000	2,949,000	[7] 2,949,000	[8] 2,949,000	5,048,000
Total Austria-Hungary	708,554,000	745,531,000	639,407,000	682,927,000	689,980,000
Belgium	88,652,000	88,192,000	82,846,000	90,358,000	[7] 90,358,000
Bulgaria	364,000	300,000	340,000	323,000	432,000
Denmark	28,454,000	24,426,000	29,752,000	24,326,000	30,517,000
Finland	20,432,000	18,765,000	[7] 16,194,000	17,887,000	16,322,000
France	372,076,000	512,229,000	625,021,000	613,041,000	313,189,000
Germany	1,577,653,000	1,673,246,000	1,702,803,000	1,716,143,000	1,597,174,000
Greece	[9] 550,000	[9] 550,000	[9] 550,000	[10] 550,000	[7] 550,000
Italy	[11] 60,000,000	[11] 60,000,000	[11] 60,000,000	63,273,000	56,550,000
Luxemburg	6,491,000	7,295,000	5,878,000	6,099,000	5,085,000
Malta	378,000	793,000	692,000	372,000	654,000
Netherlands	95,503,000	94,401,000	96,695,000	97,275,000	88,376,000
Norway	20,995,000	16,956,000	28,030,000	22,084,000	22,398,000
Roumania	4,636,000	3,860,000	4,310,000	3,813,000	4,846,000

1 Included in "other."
2 Estimated from returns of census year, 1900.
3 Data for 1906.
4 Data for 1908.
5 Census shows 19,000 hectares (46,949 acres) yielding 15,000 kilograms per hectare (223 bushels per acre).
6 Data for 1905.
7 Year preceding.
8 Data for 1907.
9 Data for 1909.
10 Unofficial estimate.
11 Average production as unofficially estimated.

POTATOES—Continued.

Potato crop of countries named, 1906–1910—Continued.

Country.	1906	1907	1908	1909	1910
EUROPE—continued.					
Russia:	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Russia proper	630,211,000	694,487,000	682,454,000	764,943,000	(1)
Poland	296,662,000	327,689,000	366,433,000	396,023,000	(1)
Northern Caucasia	12,844,000	11,932,000	11,248,000	12,520,000	(1)
Total Russia (European)	939,717,000	1,034,108,000	1,060,135,000	1,173,486,000	[2] 1,343,268,000
Servia	1,799,000	876,000	645,000	1,396,000	3,110,000
Spain	[3] 84,000,000	[3] 84,000,000	[3] 84,000,000	[3] 84,000,000	91,014,000
Sweden	63,829,000	57,823,000	78,020,000	61,981,000	68,591,000
Switzerland	[4] 47,000,000	[4] 47,000,000	49,971,000	44,092,000	46,712,000
United Kingdom:					
Great Britain	128,005,000	111,159,000	146,258,000	137,180,000	129,813,000
Ireland	99,328,000	83,869,000	119,455,000	119,572,000	107,178,000
Total Great Britain and Ireland	227,333,000	195,028,000	265,713,000	256,752,000	236,991,000
Total	4,348,416,000	4,665,379,000	4,831,002,000	4,960,178,000	4,706,117,000
ASIA.					
Japan	18,691,000	20,310,000	21,174,000	21,996,000	[5] 21,996,000
Russia (Asiatic) [7]	16,481,000	17,076,000	31,759,000	31,042,000	(6)
Total	35,172,000	37,386,000	52,933,000	53,038,000	21,996,000
AFRICA.					
Algeria	1,684,000	1,803,000	1,549,000	1,727,000	1,727,000
Union of South Africa:					
Cape of Good Hope	[8] 1,500,000	[8] 1,500,000	1,304,000	[9] 1,304,000	[9] 1,304,000
Natal	454,000	444,000	405,000	392,000	392,000
Transvaal	[5] 618,000	549,000	519,000	410,000	773,000
Total, Union of South Africa	2,572,000	2,493,000	2,228,000	2,106,000	2,469,000
Total	4,256,000	4,296,000	3,777,000	3,833,000	4,196,000
AUSTRALASIA.					
Australia:					
Queensland	422,000	591,000	492,000	431,000	506,000
New South Wales	1,881,000	4,288,000	2,086,000	2,680,000	3,739,000
Victoria	4,307,000	6,229,000	5,044,000	5,706,000	6,532,000
South Australia	756,000	832,000	756,000	805,000	693,000
Western Australia	235,000	188,000	212,000	250,000	222,000
Tasmania	2,412,000	6,807,000	5,431,000	4,540,000	2,758,000
Total Australia	10,013,000	18,935,000	14,021,000	14,412,000	14,450,000
New Zealand	4,607,000	6,342,000	5,339,000	7,288,000	6,739,000
Total Australasia	14,620,000	25,277,000	19,360,000	21,700,000	21,189,000
Grand total	4,789,112,000	5,121,643,000	5,280,184,000	5,545,707,000	5,196,715,000

[1] No data.
[2] Includes Russia, Asiatic.
[3] Average production as unofficially estimated.
[4] Average 1908–1910.
[5] Year preceding.
[6] Included in "Russia, European."
[7] 1906–1907 represents 10 Governments and districts; 1908 and 1909, 27 Governments and districts.
[8] Unofficial estimate.
[9] Data for 1908.

POTATOES—Continued.

Average yield of potatoes in countries named, bushels per acre, 1900–1910.

Year.	United States.	Russia, European.[1]	Germany.[1]	Austria.[1]	Hungary proper.[1]	France.	United Kingdom.[2]
Average (1900–1909)	91.4	99.9	200.0	151.1	118.7	133.8	193.8
1901	65.5	92.2	218.1	155.8	126.8	115.6	216.9
1902	96.0	107.5	199.4	152.4	113.3	114.1	183.7
1903	84.7	91.1	197.0	126.2	125.0	120.2	166.1
1904	110.4	88.4	164.2	126.1	86.2	123.4	195.6
1905	87.0	106.6	216.7	182.5	126.8	142.5	218.8
1906	102.2	94.9	193.3	158.4	128.7	99.5	192.2
1907	95.4	102.4	205.3	173.2	126.6	107.7	171.0
1908	85.7	102.9	209.2	154.0	96.6	163.7	231.1
1909	106.1	111.5	208.9	157.3	125.2	160.3	222.1
1910	93.8	....	196.1	160.0	117.4	86.1	209.1
Average (1901–1910)	92.7	....	200.8	154.6	117.3	123.3	200.7

[1] Bushels of 60 pounds. [2] Winchester bushels.

Acreage, production, and value of potatoes in the United States in 1911.

State and Division.	Acreage.	Production.	Farm value Dec 1.
	Acres.	*Bushels.*	*Dollars.*
Maine	118,000	21,240,000	16,355,000
N. Hampshire	17,000	2,125,000	1,849,000
Vermont	26,000	2,730,000	2,157,000
Massachusetts	25,000	2,325,000	2,232,000
Rhode Island	5,000	550,000	583,000
Connecticut	23,000	1,955,000	2,053,000
New York	375,000	27,750,000	24,975,000
New Jersey	84,000	6,132,000	6,439,000
Pennsylvania	270,000	15,120,000	14,062,000
N. Atlantic	943,000	79,927,000	70,705,000
Delaware	11,000	660,000	634,000
Maryland	39,000	1,755,000	1,597,000
Virginia	95,000	4,275,000	4,104,000
West Virginia	44,000	1,980,000	2,059,000
North Carolina	31,000	1,488,000	1,607,000
South Carolina	10,000	700,000	854,000
Georgia	12,000	864,000	950,000
Florida	10,000	900,000	1,305,000
S. Atlantic	252,000	12,622,000	13,110,000
Ohio	190,000	12,350,000	10,374,000
Indiana	89,000	5,162,000	4,491,000
Illinois	138,000	6,900,000	6,210,000
Michigan	330,000	31,020,000	22,024,000
Wisconsin	280,000	32,480,000	20,138,000
N. C. E. of Miss. River	1,027,000	87,912,000	63,237,000
Minnesota	225,000	25,875,000	15,008,000
Iowa	174,000	12,876,000	9,399,000
Missouri	95,000	2,565,000	2,616,000
North Dakota	42,000	5,040,000	2,772,000
South Dakota	56,000	4,032,000	2,822,000
Nebraska	116,000	6,032,000	5,549,000
Kansas	80,000	1,760,000	1,866,000
N. C. W. of Miss. River	788,000	58,180,000	40,032,000
Kentucky	52,000	2,028,000	2,170,000
Tennessee	38,000	1,558,000	1,683,000
Alabama	15,000	1,170,000	1,381,000
Mississippi	9,000	747,000	859,000
Louisiana	22,000	1,518,000	1,518,000
Texas	50,000	2,850,000	3,591,000
Oklahoma	30,000	540,000	670,000
Arkansas	26,000	1,430,000	1,644,000
S. Central	242,000	11,841,000	13,516,000
Montana	27,000	4,050,000	2,997,000
Wyoming	10,000	420,000	588,000
Colorado	90,000	3,150,000	3,118,000
New Mexico	10,000	800,000	800,000
Arizona	1,000	95,000	133,000
Utah	15,000	2,100,000	1,785,000
Nevada	8,000	1,280,000	1,190,000
Idaho	29,000	5,220,000	3,393,000
Washington	59,000	9,440,000	6,419,000
Oregon	46,000	5,980,000	4,007,000
California	72,000	9,720,000	8,748,000
Far Western	367,000	42,255,000	33,178,000
United States	3,619,000	292,737,000	233,778,000

Condition of the potato crop in the United States on the first of months named, 1890–1911.

Year.	July.	Aug.	Sept.	Oct.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*
1890	91.7	77.4	65.7	61.7
1891	95.3	96.5	94.8	91.3
1892	90.0	86.8	74.8	67.7
1893	94.8	86.0	71.8	71.2
1894	92.3	74.0	62.4	64.3
1895	91.5	89.7	90.8	87.4
1896	99.0	94.8	83.2	81.7
1897	87.8	77.9	66.7	61.6
1898	95.5	83.9	77.7	72.5
1899	93.8	93.0	86.3	81.7
1900	91.3	88.2	80.0	74.4
1901	87.4	62.3	52.2	54.0
1902	92.9	94.8	89.1	82.5
1903	88.1	87.2	84.3	74.6
1904	93.9	94.1	91.6	89.5
1905	91.2	87.2	80.9	74.3
1906	91.5	89.0	85.3	82.2
1907	90.2	88.5	80.2	77.0
1908	89.6	82.9	73.7	68.7
1909	93.0	85.8	80.9	78.8
1910	86.3	75.8	70.5	71.8
1911	76.0	62.3	59.8	62.3

POTATOES—Continued.

Acreage, production, value, prices, exports, etc., of potatoes in the United States, 1849–1911.

Year.	Acreage planted and harvested.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago price per bushel, Burbank.				Domestic exports, fiscal year beginning July 1.	Imports during fiscal year beginning July 1.
						December.		May of following year.			
						Low.	High.	Low.	High.		
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels.*
1849 [1]			*65,798,000*							*155,595*	
1859 [1]			*111,149,000*							*380,372*	
1866	1,069,000	100.2	107,201,000	47.3	50,723,000					512,380	198,265
1867	1,192,000	82.0	97,783,000	65.9	64,462,000					378,605	209,555
1868	1,132,000	93.8	106,090,000	59.3	62,919,000					508,249	138,470
1869	1,222,000	109.5	133,886,000	42.9	57,481,000					596,968	75,336
1869 [1]			*143,337,000*								
1870	1,325,000	86.6	114,775,000	65.0	74,621,000					553,070	458,758
1871	1,221,000	98.7	120,462,000	53.9	64,905,000					621,537	96,259
1872	1,331,000	85.3	113,516,000	53.5	60,692,000					515,306	346,840
1873	1,295,000	81.9	106,089,000	65.2	69,154,000					497,413	549,073
1874	1,310,000	80.9	105,981,000	61.5	65,223,000					609,642	188,757
1875	1,510,000	110.5	166,877,000	34.4	57,358,000					704,379	92,148
1876	1,742,000	71.7	124,827,000	61.9	77,320,000					529,650	3,205,555
1877	1,792,000	94.9	170,092,000	43.7	74,272,000					744,409	528,584
1878	1,777,000	69.9	124,127,000	58.7	72,924,000					625,342	2,624,149
1879	1,837,000	98.9	181,626,000	43.6	79,154,000					696,080	721,868
1879 [1]			*169,459,000*								
1880	1,843,000	91.0	167,660,000	48.3	81,062,000					638,840	2,170,372
1881	2,042,000	53.5	109,145,000	91.0	99,291,000					408,286	8,789,860
1882	2,172,000	78.7	170,973,000	55.7	95,305,000					439,443	2,362,362
1883	2,289,000	90.9	208,164,000	42.2	87,849,000					554,613	425,408
1884	2,221,000	85.8	190,642,000	39.6	75,524,000					380,868	658,633
1885	2,266,000	77.2	175,029,000	44.7	78,153,000			33	50	494,948	1,937,416
1886	2,287,000	73.5	168,051,000	46.7	78,442,000	44	47	65	90	434,864	1,432,490
1887	2,357,000	56.9	134,103,000	68.2	91,507,000	70	83	65	85	403,880	8,259,538
1888	2,533,000	79.9	202,365,000	40.2	81,414,000	30	37	24	45	471,955	883,380
1889	2,648,000	77.4	204,881,000	35.4	72,611,000	33	45	30	60	406,618	3,415,578
1889 [1]			*217,546,000*								
1890	2,652,000	55.9	148,290,000	75.8	112,342,000	82	93	95	110	341,189	5,401,912
1891	2,715,000	93.7	254,424,000	35.8	91,013,000	30	40	30	50	557,022	186,871
1892	2,548,000	61.5	156,655,000	66.1	103,568,000	60	72	70	98	845,720	4,317,021
1893	2,605,000	70.3	183,034,000	59.4	108,662,000	51	60	64	88	803,111	3,002,578
1894	2,738,000	62.4	170,787,000	53.6	91,527,000	43	58	40	70	572,957	1,341,533
1895	2,955,000	100.6	297,237,000	26.6	78,985,000	18	24	10	23	680,049	175,240
1896	2,767,000	91.1	252,235,000	28.6	72,182,000	18	26	19	26	926,646	246,178
1897	2,535,000	64.7	164,016,000	54.7	89,643,000	50	62	60	87	605,187	1,171,378
1898	2,558,000	75.2	192,306,000	41.4	79,575,000	30	36	33	52	579,833	530,420
1899	2,581,000	88.6	228,783,000	39.0	89,329,000	35	46	27	39	809,472	155,861
1899 [1]	*2,939,000*	*93.0*	*273,318,000*								
1900	2,611,000	80.8	210,927,000	43.1	90,811,000	40	48	35	60	741,483	371,911
1901	2,864,000	65.5	187,598,000	76.7	143,979,000	75	82	58	100	528,484	7,656,162
1902	2,966,000	96.0	284,633,000	47.1	134,111,000	42	48	42	60	843,075	358,505
1903	2,917,000	84.7	247,128,000	61.4	151,638,000	60	66	95	116	484,042	3,166,581
1904	3,016,000	110.4	332,830,000	45.3	150,673,000	32	38	20	25	1,163,270	181,199
1905	2,997,000	87.0	260,741,000	61.7	160,821,000	55	66	48	73	1,000,326	1,948,160
1906	3,013,000	102.2	308,038,000	51.1	157,547,000	40	43	55	75	1,530,461	176,917
1907	3,128,000	95.4	298,262,000	61.8	184,184,000	46	58	50	80	1,203,894	403,952
1908	3,257,000	85.7	278,985,000	70.6	197,039,000	60	77	70	150	763,651	8,383,966
1909	3,525,000	106.8	376,537,000	54.9	206,545,000	20	58	[2] 16	[2] 34	999,476	353,208
1909 [1]	*3,669,000*	*106.1*	*389,195,000*								
1910 [3]	3,720,000	93.8	349,032,000	55.7	194,566,000	[2] 30	[2] 48	[2] 35	[2] 75	2,383,887	216,984
1911 [3]	3,619,000	80.9	292,737,000	79.9	233,778,000	[2] 70	[2] 100				

[1] Census figures. [2] Fair to fancy. [3] Figures adjusted to census basis.

POTATOES—Continued.

Average yield per acre and farm price per bushel of potatoes in the United States.

State and Division.	Yield per acre.						Farm price per bushel.								
	10-year averages.				1910	1911	10-year averages for Dec. 1.				Dec. 1, 1910.	Quarterly, 1911.			
	1870–1879	1880–1889	1890–1899	1900–1909			1870–1879	1880–1889	1890–1899	1900–1909		Mar. 1.	June 1.	Sept. 1.	Dec. 1.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Maine	110	94	122	180	220	180	51	57	54	56	42	36	40	90	77
New Hampshire	112	88	103	114	150	125	56	57	58	66	52	51	67	86	87
Vermont	133	95	109	113	130	105	44	51	47	55	45	50	60	115	79
Massachusetts	107	92	105	103	125	93	68	69	68	78	70	60	67	96	96
Rhode Island	91	88	116	124	136	110	75	70	69	82	69	58	72	105	106
Connecticut	87	78	94	95	125	85	72	68	64	80	70	61	75	108	105
New York	92	76	79	88	102	74	52	50	49	59	48	40	47	113	90
New Jersey	80	76	79	97	105	73	71	62	60	72	65	60	80	96	105
Pennsylvania	88	72	77	82	88	56	57	54	53	64	52	52	57	114	93
N. Atlantic	95.3	78.3	85.4	98.8	117.1	84.8	54.8	54.1	52.4	61.4	49.9	45.3	52.9	105.5	88.5
Delaware	84	66	58	82	103	60	68	58	56	64	60	65	63	124	96
Maryland	70	68	68	80	95	45	66	57	54	61	54	49	58	121	91
Virginia	71	63	70	79	98	45	57	57	54	64	58	63	60	113	96
West Virginia	78	68	69	86	92	45	52	54	54	66	67	71	69	144	104
North Carolina	88	64	71	73	89	48	63	62	60	73	73	80	81	110	108
South Carolina	79	57	67	79	90	70	91	81	86	105	105	118	125	123	122
Georgia	77	62	61	72	82	72	109	86	83	100	105	103	100	126	110
Florida	.....	70	73	81	90	90	.....	90	100	119	100	145	80	149	145
S. Atlantic	74.9	64.8	68.8	79.6	94.2	50.1	62.8	60.6	57.5	69.7	66.0	73.2	70.0	123.6	103.9
Ohio	82	69	65	84	82	65	57	54	51	59	51	49	52	133	84
Indiana	70	68	62	79	84	58	56	52	53	60	50	49	54	141	87
Illinois	76	74	66	85	75	50	58	52	56	64	59	62	68	140	90
Michigan	84	78	76	88	105	94	53	44	37	44	31	30	34	108	71
Wisconsin	86	82	83	92	95	116	46	44	37	45	38	35	37	86	62
N. C. E. Miss. R.	79.4	74.2	71.1	86.6	92.0	85.6	53.2	48.4	44.5	51.0	41.0	40.2	43.9	113.3	71.9
Minnesota	98	94	87	88	61	115	40	38	34	44	64	59	68	86	58
Iowa	93	80	74	82	72	74	42	43	44	53	60	61	66	125	73
Missouri	78	72	71	81	86	27	51	48	50	62	68	71	79	166	102
North Dakota	.....	85	90	94	41	120	.....	39	36	46	91	91	106	89	55
South Dakota	.....	85	68	83	44	72	.....	39	42	49	85	86	97	102	70
Nebraska	91	75	62	83	60	52	43	44	55	55	84	81	104	135	92
Kansas	87	69	60	76	57	22	59	63	59	73	90	92	106	154	106
N. C. W. Miss. R.	87.7	78.1	72.1	83.0	63.8	73.8	45.3	45.9	44.6	52.9	70.8	70.7	81.4	126.6	68.8
Kentucky	73	63	62	74	92	39	55	52	54	65	62	64	74	138	107
Tennessee	80	62	58	70	80	41	54	52	56	67	65	74	73	124	108
Alabama	75	64	64	73	80	78	100	87	84	95	94	92	90	134	118
Mississippi	78	65	66	82	85	83	98	84	80	92	94	107	97	160	115
Louisiana	70	64	66	66	55	69	95	85	81	88	90	95	81	113	100
Texas	91	64	67	66	51	57	123	90	90	97	110	115	87	148	126
Oklahoma	.....	.....	.....	76	60	18	.....	.....	.....	88	100	107	109	192	124
Arkansas	87	70	69	70	84	55	82	69	65	81	85	100	91	150	115
S. Central	76.4	63.8	63.5	70.8	72.4	48.9	68.6	62.6	64.2	80.4	81.7	91.6	86.0	146.2	114.1
Montana	.....	104	117	150	120	150	.....	68	53	57	85	95	116	110	74
Wyoming	.....	92	122	145	100	42	.....	67	60	67	82	90	108	210	140
Colorado	[1] 120	82	91	130	100	35	[1] 78	71	52	60	55	61	73	155	99
New Mexico	.....	78	69	77	47	80	.....	75	74	94	104	80	108	130	100
Arizona	.....	66	72	.....	92	95	.....	76	74	.....	126	97	135	151	140
Utah	.....	87	120	144	142	140	.....	45	42	50	59	65	95	77	85
Nevada	104	91	132	155	150	160	167	84	58	75	80	100	140	130	93
Idaho	.....	95	128	148	142	180	.....	62	50	53	65	80	120	67	65
Washington	.....	118	127	134	131	160	.....	49	40	50	73	78	130	91	68
Oregon	115	98	103	109	105	130	65	50	46	58	70	80	137	84	67
California	116	89	89	125	130	135	95	63	55	71	85	114	135	101	90
Far Western	113.6	94.0	102.0	129.2	116.9	115.1	88.8	60.4	49.0	59.3	71.8	85.7	117.6	107.0	78.5
United States	87.9	76.5	76.4	91.4	93.8	80.9	54.1	51.2	48.1	57.4	55.7	55.3	63.3	113.7	79.9

[1] The Territories.

POTATOES—Continued.

Wholesale prices of potatoes per bushel, 1898–1911.

Date.	Chicago.		Milwaukee.		St. Louis.		Cincinnati.	
	Burbank, per bushel.		Per bushel.		Burbank, per bushel.		Per bushel.[1]	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1898	29	87	25	90	30	85	125	375
1899	26	75	15	90	25	75	110	600
1900	25	50	20	80	27	54	32	57
1901	30	125	25	185	18	140	30	120
1902	30	100	....	....	41	105	90	300
1903	38	85	35	90	40	125	120	300
1904	31	122	20	120	36	125	120	480
1905	18	72	10	70	27	175	25	80
1906	40	87	25	87	35	125	45	105
1907	30	75	25	90	43	125	25	85
1908.								
January	52	65	53	75	62	69	60	68
February	58	73	65	70	67	77	65	82
March	62	75	63	70	71	78	70	80
April	60	77	65	80	73	78	70	85
May	50	80	58	80	65	74	60	85
June	53	150	58	150	100	105	60	135
July	70	110	55	110	....	....	110	135
August	58	90	60	85	....	....	85	115
September	58	78	60	80	72	72	75	85
October	50	81	54	80	67	70	65	80
November	57	71	58	70	69	72	65	75
December	60	77	64	70	69	75	65	80
Year	50	150	53	150	62	105	60	135
1909.								
January	60	79	60	72	73	83	72	80
February	65	95	60	88	80	93	75	90
March	80	93	70	95	89	98	85	95
April	85	110	70	115	92	108	95	115
May	70	150	80	135	85	102	95	100
June	20	145	30	105	40	140	90	120
July	15	125	20	100	40	110	50	95
August	38	66	40	90	35	62	70	75
September	42	65	45	65	45	72	55	70
October	35	55	40	60	42	56	55	60
November	15	50	30	50	40	52	30	60
December	20	58	30	50	40	50	30	48
Year	15	150	20	135	35	140	30	120
1910.	(2)							
January	40	54	25	55	49	62	35	50
February	30	48	25	50	39	50	40	50
March	20	46	20	45	34	47	30	45
April	15	31	18	35	23	35	30	35
May	16	34	18	35	32	38	30	40
June	10	28	12	35	55	100	30	35
July	10	72	12	75	45	72½	30	60
August	60	98	55	100	50	80	55	65
September	50	98	50	105	50	80	55	65
October	35	74	30	70	46	60	55	65
November	34	50	30	55	48	54	45	52
December	30	48	30	55	47	53	40	52
Year	10	98	12	105	23	100	30	65
1911.								
January	30	51	30	55	47	57	40	55
February	40	50	32	50	47	58	43	55
March	35	50	25	50	47	63	43	55
April	38	65	30	65	57	79	55	70
May	35	75	30	70	42	71	45	65
June	30	225	30	135	46	140	45	195
July	60	180	40	160	85	200	110	195
August	100	150	90	140	75	145	110	150
September	55	130	55	120	70	105	80	150
October	47	85	50	80	69	81	65	90
November	50	95	60	90	73	100	65	100
December	70	100	72	95	68	97	88	100
Year	30	225	25	160	42	200	40	195

[1] Per barrel for 1898–99 and 1902–1904.

[2] Fair to fancy.

POTATOES—Continued.

Average farm price of potatoes per bushel on the first of each month, 1910–11.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	54.1	56.0	48.3	54.8	66.0	79.1	39.0	45.8	69.4	56.6	86.5	89.8	74.9	60.7
February	55.1	56.2	48.2	55.5	72.0	79.9	39.6	44.1	69.3	56.2	88.9	93.9	78.8	62.1
March	55.3	54.6	45.3	52.6	73.2	83.1	40.2	40.2	70.7	56.7	91.6	99.6	85.7	62.5
April	55.5	47.4	45.0	41.9	71.4	77.1	40.0	33.2	73.4	53.9	89.7	94.4	88.4	57.3
May	62.5	38.4	53.0	34.0	72.2	66.2	46.2	23.2	79.2	44.8	90.8	85.6	102.1	48.3
June	63.3	37.4	52.9	32.1	70.0	62.6	43.9	24.1	81.4	44.3	86.0	80.8	117.6	48.2
July	96.3	40.1	74.4	33.6	94.0	65.4	74.3	27.1	162.2	50.1	124.7	74.9	139.9	52.0
August	136.0	64.9	113.4	63.1	132.0	64.5	140.2	58.4	183.0	75.6	156.9	73.1	137.7	68.0
September	113.7	72.9	105.5	65.2	123.6	63.8	113.3	69.7	126.6	90.6	146.2	79.8	107.0	79.0
October	88.3	67.8	85.2	54.7	114.7	65.1	73.8	65.0	97.9	90.1	136.1	85.4	88.3	76.1
November	76.3	55.7	78.3	45.5	105.4	65.6	60.8	43.4	74.1	74.4	119.8	86.5	77.0	72.9
December	79.9	55.5	88.5	50.6	103.9	66.3	71.9	41.2	68.8	71.3	114.1	84.4	78.5	71.9

HAY.

Acreage, production, value, prices, and exports of hay in the United States, 1849–1911.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per ton Dec 1.	Farm value Dec. 1.	Chicago prices No. 1 timothy per ton, by carload lots. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, fiscal year beginning July 1.
	Acres.	*Tons.*[1]	*Tons.*[1]	*Dolls.*	*Dollars.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Tons.*[2]
1849[3]	......	......	*13,839,000*	......	......	......	......	......	......	......
1859[3]	......	......	*19,084,000*	......	......	......	......	......	......	......
1866	17,669,000	1.23	21,779,000	10.14	220,836,000	......	......	......	......	5,028
1867	20,021,000	1.31	26,277,000	10.21	268,301,000	......	......	......	......	5,645
1868	21,542,000	1.21	26,142,000	10.08	263,589,000	......	......	......	......	......
1869	18,591,000	1.42	26,420,000	10.18	268,933,000	......	......	......	......	6,723
1869[3]	......	......	*27,316,000*	......	......	......	......	......	......	......
1870	19,862,000	1.23	24,525,000	12.47	305,743,000	......	......	......	......	4,581
1871	19,009,000	1.17	22,239,000	14.30	317,940,000	......	......	......	......	5,266
1872	20,319,000	1.17	23,813,000	12.94	308,025,000	......	......	......	......	4,557
1873	21,894,000	1.15	25,085,000	12.53	314,241,000	......	......	......	......	4,889
1874	21,770,000	1.15	25,134,000	11.94	300,222,000	......	......	......	......	7,183
1875	23,508,000	1.19	27,874,000	10.78	300,378,000	......	......	......	......	7,528
1876	25,283,000	1.22	30,867,000	8.97	276,991,000	......	......	9.00	10.00	7,287
1877	25,368,000	1.25	31,629,000	8.37	264,880,000	9.50	10.50	9.75	10.75	9.514
1878	26,931,000	1.47	39,608,000	7.20	285,016,000	8.00	8.50	9.00	11.50	8.127
1879	27,485,000	1.29	35,493,000	9.32	330,804,000	14.00	14.50	14.00	15.00	13,739
1879[3]	*30,631,000*	*1.15*	*35,151,000*	......	......	......	......	......	......	......
1880	25,864,000	1.23	31,925,000	11.65	371,811,000	15.00	15.50	17.00	19.00	12,662
1881	30,889,000	1.14	35,135,000	11.82	415,131,000	16.00	16.50	15.00	16.50	10,570
1882	32,340,000	1.18	38,138,000	9.73	371,170,000	11.50	12.25	12.00	13.00	13,309
1883	35,516,000	1.32	46,864,000	8.19	383,834,000	9.00	10.00	12.50	17.00	16,908
1884	38,572,000	1.26	48,470,000	8.17	396,139,000	10.00	11.50	15.50	17.50	11,142
1885	39,850,000	1.12	44,732,000	8.71	389,753,000	11.00	12.00	10.00	12.00	13,390
1886	36,502,000	1.15	41,796,000	8.46	353,438,000	9.50	10.50	11.00	12.50	13,873
1887	37,665,000	1.10	41,454,000	9.97	413,440,000	13.50	14.50	17.00	21.00	18,198
1888	38,592,000	1.21	46,643,000	8.76	408,500,000	11.00	11.50	10.50	21.00	21,928
1889	52,949,000	1.26	66,831,000	7.04	470,394,000	9.00	10.00	9.00	14.00	36,274
1889[3]	*52,949,000*	*1.26*	*66,831,000*	......	......	......	......	......	......	......
1890	*50,713,000*	1.19	60,198,000	7.87	473,570,000	9.00	10.50	12.50	15.50	28,066
1891	51,044,000	1.19	60,818,000	8.12	494,114,000	12.50	15.00	13.50	14.00	35,201
1892	50,853,000	1.18	59,824,000	8.20	490,428,000	11.00	11.50	12.00	13.50	33,084
1893	49,613,000	1.33	65,766,000	8.68	570,883,000	10.00	10.50	10.00	10.50	54,446
1894	48,321,000	1.14	54,874,000	8.54	468,578,000	10.00	11.00	10.00	10.25	47,117

[1] 2,000 pounds. [2] 2,240 pounds. [3] Census figures.

HAY—Continued.

Acreage, production, value, prices, and exports of hay in the United States, 1849–1911—Continued.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per ton Dec. 1.	Farm value Dec. 1.	Chicago prices No. 1 timothy per ton, by carload lots. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, fiscal year beginning July 1.
	Acres.	*Tons.*	*Tons.*	*Dolls.*	*Dollars.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Tons.*
1895	44,206,000	1.06	47,079,000	8.35	393,186,000	12.00	12.50	11.50	12.00	59,052
1896	43,260,000	1.37	59,282,000	6.55	388,146,000	8.00	8.50	8.50	9.00	61,658
1897	42,427,000	1.43	60,665,000	6.62	401,391,000	8.00	8.50	9.50	10.50	81,827
1898	42,781,000	1.55	66,377,000	6.00	398,061,000	8.00	8.25	9.50	10.50	64,916
1899	41,328,000	1.37	56,656,000	7.27	411,926,000	10.50	11.50	10.50	12.50	72,716
1899[1]	*52,351,000*	*1.09*	*57,002,000*	......	....	......	......	......	......	....
1900	39,133,000	1.28	50,111,000	8.89	445,539,000	11.50	14.00	12.50	13.50	89,364
1901	39,391,000	1.28	50,591,000	10.01	506,192,000	13.00	13.50	12.50	13.50	153,431
1902	39,825,000	1.50	59,858,000	9.06	542,036,000	12.00	12.50	13.50	15.00	50,974
1903	39,934,000	1.54	61,306,000	9.07	556,276,000	10.00	12.00	12.00	15.00	60,730
1904	39,999,000	1.52	60,696,000	8.72	529,108,000	10.50	11.50	11.00	12.00	66,557
1905	39,362,000	1.54	60,532,000	8.52	515,960,000	10.00	12.00	11.50	12.50	70,172
1906	42,476,000	1.35	57,146,000	10.37	592,540,000	15.50	18.00	15.50	20.50	58,602
1907	44,028,000	1.45	63,677,000	11.68	743,507,000	13.00	17.50	13.00	14.00	77,281
1908	46,486,000	1.52	70,798,000	8.98	635,423,000	11.50	12.00	12.00	13.00	64,641
1909	45,744,000	1.42	64,938,000	10.62	689,345,000	16.00	17.00	12.50	16.00	55,007
1909[1]	....	......	....	......	....	......	......	......	......	....
1910	45,691,000	1.33	60,978,000	12.26	747,769,000	16.00	19.00	18.50	23.50	55,223
1911	43,017,000	1.10	47,444,000	14.64	694,570,000	20.00	22.00	......	......	....

[1] Census figures.

Acreage, production, and value of hay in the United States, 1911.

State and Division.	Acreage.	Production.	Farm value December 1.
	Acres.	*Tons.*	*Dollars.*
Maine	1,400,000	1,540,000	22,176,000
New Hampshire	640,000	672,000	11,558,000
Vermont	930,000	1,209,000	16,926,000
Massachusetts	584,000	631,000	14,513,000
Rhode Island	61,000	61,000	1,470,000
Connecticut	490,000	539,000	12,666,000
New York	4,763,000	4,858,000	86,958,000
New Jersey	428,000	449,000	9,878,000
Pennsylvania	3,148,000	3,148,000	62,960,000
N. Atlantic	12,444,000	13,107,000	239,105,000
Delaware	72,000	63,000	1,418,000
Maryland	276,000	199,000	4,458,000
Virginia	437,000	280,000	5,740,000
West Virginia	648,000	428,000	8,560,000
North Carolina	161,000	169,000	2,873,000
South Carolina	64,000	69,000	1,173,000
Georgia	87,000	117,000	1,989,000
Florida	18,000	23,000	426,000
S. Atlantic	1,763,000	1,348,000	26,637,000
Ohio	2,556,000	2,505,000	47,344,000
Indiana	1,848,000	1,737,000	29,182,000
Illinois	2,376,000	1,948,000	33,116,000
Michigan	2,411,000	2,797,000	47,549,000
Wisconsin	2,079,000	2,495,000	38,922,000
N. C. E. of Miss. R.	11,270,000	11,482,000	196,113,000
Minnesota	799,000	799,000	9,508,000
Iowa	3,240,000	2,592,000	32,400,000
Missouri	2,430,000	1,458,000	19,391,000
North Dakota	192,000	211,000	1,477,000
South Dakota	459,000	252,000	2,142,000
Nebraska	1,350,000	1,148,000	11,136,000
Kansas	1,649,000	1,402,000	13,880,000
N. C. W. of Miss. R.	10,119,000	7,862,000	89,934,000
Kentucky	450,000	428,000	7,404,000
Tennessee	400,000	400,000	6,680,000
Alabama	120,000	168,000	2,150,000
Mississippi	100,000	150,000	1,650,000
Louisiana	24,000	31,000	372,000
Texas	606,000	606,000	7,211,000
Oklahoma	810,000	648,000	5,184,000
Arkansas	200,000	230,000	2,990,000
S. Central	2,710,000	2,661,000	33,641,000
Montana	612,000	1,224,000	12,240,000
Wyoming	330,000	693,000	7,138,000
Colorado	707,000	1,414,000	13,150,000
New Mexico	221,000	575,000	7,475,000
Arizona	130,000	502,000	6,024,000
Utah	380,000	950,000	8,550,000
Nevada	254,000	864,000	8,208,000
Idaho	525,000	1,628,000	12,373,000
Washington	400,000	960,000	11,520,000
Oregon	452,000	949,000	9,110,000
California	700,000	1,225,000	13,352,000
Far Western	4,711,000	10,984,000	109,140,000
United States	43,017,000	47,444,000	694,570,000

HAY—Continued.

Average farm price of hay per ton on the first of each month, 1910–11.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Central States East of Miss. R.		N. Central States West of Miss. R.		South Central States.		Far Western States.	
	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
January	12.24	11.37	14.75	15.61	14.99	13.98	12.86	11.31	9.03	7.75	11.47	11.28	10.50	11.49
February	12.29	12.35	14.48	16.10	14.79	14.96	13.09	12.12	8.67	9.41	11.68	11.97	11.32	12.34
March	12.09	12.71	14.50	17.21	14.90	15.52	12.80	12.77	8.30	9.18	11.90	12.33	10.80	12.19
April	11.89	12.73	14.13	17.52	15.38	16.30	12.80	12.89	8.15	8.60	11.52	12.61	10.50	12.38
May	12.29	12.21	14.43	17.49	16.31	15.73	13.79	12.00	8.23	7.93	11.59	12.30	10.52	12.07
June	13.16	11.80	15.90	16.26	18.21	15.27	15.22	11.87	8.23	7.91	11.99	12.30	10.46	11.47
July	13.99	11.71	16.53	16.31	18.36	15.13	15.64	11.87	10.91	8.06	12.83	11.62	10.15	10.78
August	14.67	11.29	17.25	13.91	20.10	14.70	15.89	12.14	12.95	8.49	13.56	10.85	9.46	10.47
September	14.61	11.87	17.43	14.51	20.35	14.62	16.59	12.93	11.91	8.88	13.08	10.96	9.06	11.22
October	14.50	11.82	17.65	14.70	19.41	14.69	16.47	12.83	11.43	8.89	12.84	11.10	9.12	10.74
November	14.62	11.96	17.61	15.01	19.72	14.56	16.91	12.98	11.74	9.00	12.56	11.22	8.83	10.75
December	14.64	12.26	18.24	14.61	19.76	15.02	17.08	12.88	11.44	8.96	12.64	11.48	9.94	11.04

Average yield per acre and farm price per ton of hay in the United States.

State and Division.	Yield per acre.						Farm price per ton.								
	10-year averages.				1910	1911	10-year averages for Dec. 1.				Dec. 1, 1910.	Quarterly, 1911.			
	1870–1879	1880–1889	1890–1899	1900–1909			1870–1879	1880–1889	1890–1899	1900–1909		Mar. 1.	June 1.	Sept. 1.	Dec. 1.
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Dolls*	*Dolls*	*Dolls*	*Dolls*	*Dolls*	*Dolls*	*Dolls*	*Dolls*	*Dolls*
Maine	0.90	0.96	0.99	1.07	1.25	1.10	12.64	11.56	10.05	11.47	12.80	13.20	12.80	14.20	14.40
New Hampshire	1.01	.94	1.01	1.07	1.20	1.05	12.94	11.72	11.80	14.34	15.80	13.90	16.00	17.10	17.20
Vermont	1.06	1.07	1.22	1.28	1.35	1.30	10.85	10.32	9.56	11.13	12.40	11.90	12.50	14.10	14.00
Massachusetts	1.13	1.10	1.20	1.27	1.28	1.08	18.81	17.02	15.43	17.11	19.10	18.80	18.50	23.00	23.00
Rhode Island	1.05	.99	.97	1.12	1.18	1.00	22.02	16.72	16.18	18.15	19.60	19.50	22.00	23.40	24.10
Connecticut	1.21	1.01	1.03	1.14	1.35	1.10	18.89	15.87	14.83	15.88	19.00	20.80	22.00	25.50	23.50
New York	1.20	1.13	1.12	1.22	1.32	1.02	12.68	12.02	10.09	12.10	13.70	13.50	14.60	16.20	17.90
New Jersey	1.24	1.13	1.19	1.32	1.50	1.05	17.72	15.11	13.32	15.43	18.20	17.80	20.60	20.30	22.00
Pennsylvania	1.19	1.15	1.19	1.32	1.38	1.00	13.88	12.11	10.85	13.45	15.00	15.10	17.70	18.70	20.00
N. Atlantic	1.14	1.09	1.13	1.23	1.33	1.05	13.56	12.42	10.88	13.51	14.61	14.50	15.90	17.43	18.24
Delaware	1.06	1.07	1.14	1.36	1.43	.88	17.60	14.16	12.16	14.31	14.80	15.70	22.00	17.00	22.50
Maryland	1.11	1.09	1.12	1.27	1.35	.72	16.52	13.44	11.35	13.56	15.40	15.00	20.90	24.50	22.40
Virginia	1.18	1.11	1.09	1.27	1.19	.64	14.20	12.41	10.88	13.46	14.50	14.90	17.70	21.10	20.50
West Virginia	1.14	1.03	1.16	1.36	1.20	.66	11.19	10.22	10.08	13.32	15.00	14.60	17.70	20.00	20.00
North Carolina	1.28	1.16	1.41	1.54	1.50	1.05	11.06	11.66	10.55	13.44	14.60	14.30	15.60	17.20	17.00
South Carolina	1.05	1.12	1.30	1.38	1.25	1.08	18.11	13.76	10.71	13.30	16.00	16.90	18.70	17.90	17.00
Georgia	1.37	1.24	1.39	1.56	1.40	1.35	17.53	13.93	12.38	15.04	16.40	17.00	18.20	17.20	17.00
Florida	.....	1.07	1.38	1.38	1.33	1.30	.....	16.28	15.04	15.99	17.00	17.30	17.00	17.70	18.50
S. Atlantic	1.15	1.08	1.18	1.34	1.27	.76	14.01	12.18	10.81	13.55	15.02	14.90	18.21	20.35	19.76
Ohio	1.17	1.22	1.22	1.38	1.39	.98	10.69	10.35	8.52	10.06	12.50	12.80	16.80	17.80	18.90
Indiana	1.25	1.28	1.24	1.36	1.30	.94	9.61	9.03	7.89	9.62	11.90	12.00	14.00	16.50	16.80
Illinois	1.34	1.31	1.23	1.35	1.33	.82	7.94	8.02	7.65	9.53	12.00	11.60	12.60	17.10	17.00
Michigan	1.20	1.24	1.21	1.34	1.30	1.16	11.46	10.65	9.06	9.51	13.60	12.60	16.30	15.60	17.00
Wisconsin	1.36	1.19	1.29	1.56	1.00	1.20	8.28	8.87	7.43	8.88	15.10	15.80	16.60	15.30	15.60
N. C. E. Miss. R.	1.26	1.25	1.24	1.39	1.27	1.02	9.58	9.01	8.03	9.50	12.88	12.80	15.22	16.59	17.08
Minnesota	1.43	1.31	1.44	1.66	1.00	1.00	5.02	5.20	4.67	6.02	9.10	10.00	10.50	11.50	11.90
Iowa	1.42	1.26	1.34	1.55	1.05	.80	5.17	5.29	5.51	6.47	9.60	8.70	8.10	12.30	12.50
Missouri	1.32	1.21	1.23	1.28	1.30	.60	8.88	7.80	6.49	8.15	9.20	8.30	8.40	13.50	13.30
North Dakota	.....	1.27	1.35	1.39	.55	1.10	.....	4.05	3.69	4.70	7.60	10.00	9.50	7.00	7.00
South Dakota	.....	1.28	1.18	1.39	.80	.55	.....	4.05	3.55	4.47	7.10	7.00	7.40	8.70	8.50
Nebraska	1.52	1.31	1.26	1.55	1.00	.85	3.74	3.67	4.05	5.09	8.90	7.60	7.80	10.60	9.70
Kansas	1.46	1.26	1.23	1.41	1.15	.85	3.92	4.41	3.92	5.63	7.80	7.60	7.60	10.50	9.90
N. C. W. Miss. R.	1.42	1.26	1.28	1.45	1.10	.78	5.38	5.21	4.84	6.37	8.96	8.30	8.23	11.91	11.44

HAY—Continued.

Average yield per acre and farm price per ton of hay in the United States—Continued.

State and Division.	Yield per acre.						Farm price per ton								
	10-year averages.				1910	1911	10-year averages for Dec. 1.				Dec. 1, 1910.	Quarterly, 1911.			
	1870–1879	1880–1889	1890–1899	1900–1909			1870–1879	1880–1889	1890–1899	1900–1909		Mar. 1.	June 1.	Sept. 1.	Dec. 1.
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Dolls*	*Dolls*	*Dolls*	*Dolls*	*Dolls*	*Dolls*	*Dolls*	*Dolls*	*Dolls*
Kentucky	1.25	1.17	1.26	1.38	1.29	.95	11.73	10.88	9.92	11.86	13.10	13.20	14.80	17.00	17.30
Tennessee	1.32	1.22	1.31	1.52	1.40	1.00	13.54	11.66	10.57	12.48	13.40	13.50	14.40	16.00	16.70
Alabama	1.32	1.22	1.60	1.73	1.43	1.40	15.99	13.65	10.83	12.58	13.20	14.30	13.80	13.40	12.80
Mississippi	1.41	1.26	1.56	1.65	1.42	1.50	17.36	12.95	9.81	11.13	12.20	11.90	10.20	11.20	11.00
Louisiana	1.34	1.24	1.74	1.89	1.75	1.30	19.50	12.07	9.75	11.54	11.50	11.80	10.60	12.00	12.00
Texas	1.32	1.26	1.25	1.57	1.15	1.00	12.23	9.88	7.79	8.99	12.00	12.10	11.80	12.10	11.90
Oklahoma	.....	.....	.....	1.30	1.05	.80	.....	.....	.....	5.65	8.40	8.90	8.90	9.70	8.00
Arkansas	1.39	1.24	1.27	1.50	1.35	1.15	14.33	11.48	8.87	10.11	11.00	12.50	10.70	12.20	13.00
S. Central	1.28	1.22	1.31	1.46	1.22	.98	12.81	11.13	9.45	10.49	11.48	11.90	11.99	13.08	12.64
Montana	.....	1.11	1.26	1.80	1.40	2.00	.....	10.96	8.35	8.64	12.50	12.50	11.60	9.70	10.00
Wyoming	[1]1.45	1.15	1.40	2.08	2.40	2.10	[1]12.98	10.66	7.33	7.19	12.50	10.00	8.00	9.00	10.30
Colorado	.....	1.23	1.99	2.35	2.00	2.00	.....	13.58	6.84	8.67	10.80	10.20	11.50	9.20	9.30
New Mexico	.....	1.18	2.20	2.36	2.10	2.60	.....	12.52	8.84	10.78	11.50	14.10	11.50	12.00	13.00
Arizona	.....	1.20	2.14	3.03	2.10	3.86	.....	12.83	9.17	12.13	13.00	11.50	12.00	10.00	12.00
Utah	.....	1.36	2.24	2.90	3.00	2.50	.....	7.00	5.72	7.44	9.00	8.80	9.00	8.20	9.00
Nevada	1.40	1.33	2.34	2.41	3.40	3.40	19.57	11.03	7.02	8.80	10.80	11.30	11.00	9.00	9.50
Idaho	.....	1.23	2.23	2.85	3.00	3.10	.....	9.36	6.23	6.94	9.00	9.50	8.30	7.00	7.60
Washington	.....	1.32	1.77	2.28	2.10	2.40	.....	9.95	8.74	11.17	15.70	13.90	15.80	13.10	12.00
Oregon	1.51	1.43	1.77	2.11	2.10	2.10	12.51	10.68	7.54	8.86	12.10	11.60	11.20	9.00	9.60
California	1.44	1.42	1.61	1.83	1.83	1.75	15.15	11.32	9.23	10.61	9.60	10.30	9.00	8.20	10.90
Far Western	1.44	1.37	1.76	2.26	2.21	2.33	14.58	10.94	7.88	8.85	11.04	10.80	10.46	9.06	9.94
United States	1.23	1.20	1.28	1.44	1.33	1.10	10.88	9.25	7.62	9.59	12.26	12.09	13.16	14.61	14.64

[1] The Territories.

Wholesale prices of hay (baled) per ton, 1898–1911.

Date.	Chicago.		Cincinnati.		St. Louis.		New York.	
	No. 1 timothy.		No. 1 timothy.		No. 1 timothy.		No. 1 timothy.[1]	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1898	$7.50	$10.50	$7.50	$10.25	$7.00	$12.50	$0.65	$0.80
1899	7.50	13.00	7.75	13.00	8.00	12.00	.65	.95
1900	10.00	14.00	11.50	15.00	9.75	14.50	.87½	.97½
1901	11.50	15.00	11.50	15.50	11.50	17.50	.87½	1.00
1902	10.00	17.50	11.00	16.50	9.50	16.00	17.00	22.00
1903	10.00	15.00	11.50	19.50	9.50	25.00	16.00	26.00
1904	9.00	15.00	11.00	15.50	10.00	13.50	15.00	19.00
1905	10.00	12.50	10.00	13.50	9.00	15.50	14.00	19.00
1906	9.50	18.00	11.00	19.50	11.00	20.00	15.00	23.00
1907	13.00	21.50	14.00	22.75	14.00	24.00	1.00	1.25
1908.							Per ton.	
January	12.50	13.50	14.25	16.50	13.00	18.00	20.00	21.00
February	13.00	13.50	13.75	15.25	13.00	16.50	18.00	20.00
March	12.00	13.50	13.50	15.75	13.00	16.50	19.00	21.00
April	13.00	14.00	13.75	15.00	13.00	16.50	17.00	19.00
May	13.00	14.00	13.00	14.25	14.00	17.00	18.00	19.50
June	10.00	11.00	11.50	12.75	10.50	16.00	16.00	18.00
July	10.00	10.50	12.50	14.00	10.50	16.00	15.00	17.00
August	10.00	11.00	11.50	12.75	10.00	16.00	16.50	18.00
September	10.00	10.50	11.75	13.00	12.00	15.00	14.00	17.00
October	10.00	11.50	12.50	13.50	11.50	13.50	15.00	17.00
November	11.50	12.50	12.50	13.00	11.00	14.50	16.00	16.50
December	11.50	12.00	12.50	14.00	10.50	14.00	17.00	18.00
Year	10.00	14.00	11.50	16.50	10.00	18.00	14.00	21.00

[1] Per hundred pounds, 1898 to 1901.

HAY—Continued.

Wholesale prices of hay (baled) per ton, 1898-1911—Continued.

Date.	Chicago.		Cincinnati.		St. Louis.		New York.	
	No. 1 timothy.		No. 1 timothy.		No. 1 timothy.		No. 1 timothy.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1909.								
January	$11.00	$12.00	$13.25	$13.75	$12.00	$14.00	$16.00	$17.50
February	11.00	12.00	12.75	13.25	12.00	15.00	16.00	16.50
March	11.00	12.00	12.00	13.75	12.00	15.50	16.00	16.50
April	12.00	13.00	13.50	15.50	12.00	17.00	15.50	17.50
May	12.00	13.00	14.50	16.00	14.50	18.50	17.00	19.00
June	13.00	14.00	14.75	17.00	14.00	17.50	18.50	20.00
July	12.50	13.00	13.00	16.50	15.00	17.50	19.00	20.00
August	14.50	15.00	14.00	14.50	12.00	17.50	19.50	21.00
September	13.00	14.00	14.00	15.50	11.50	15.50	18.00	18.50
October	13.00	14.00	15.00	15.50	13.50	15.50	18.50	18.50
November	13.00	15.50	14.50	16.00	14.00	17.00	18.50	19.00
December	16.00	17.00	16.00	17.25	15.00	17.00	19.50	20.00
Year	11.00	17.00	12.00	17.25	11.50	18.50	15.50	21.00
1910.								
January	16.50	18.50	17.50	19.25	16.00	18.00	21.00	24.00
February	17.00	18.00	18.00	18.75	16.00	18.00	23.00	24.00
March	16.00	18.00	18.00	19.50	16.00	18.50	23.00	24.50
April	15.00	17.00	18.50	19.25	16.00	18.50	22.50	23.00
May	12.50	16.00	17.50	18.75	16.00	18.50	22.50	23.50
June	14.50	17.00	18.50	19.50	16.00	18.50	22.50	23.50
July	16.50	21.00	18.75	22.00	15.00	20.50	24.00	26.00
August	18.00	21.00	17.50	22.50	16.00	19.50	23.00	28.00
September	16.50	18.00	17.00	19.00	16.00	18.50	22.00	23.00
October	16.00	18.50	17.50	20.50	16.00	19.00	22.00	23.00
November	16.00	19.00	17.50	18.50	15.50	18.50	22.00	22.50
December	16.00	19.00	18.00	19.00	16.00	19.50	22.00	22.00
Year	12.50	21.00	17.00	22.50	15.00	20.50	21.00	28.00
1911.								
January	16.00	20.00	18.00	19.50	16.00	19.00	21.00	21.50
February	15.00	17.50	18.25	19.00	14.50	18.50	20.50	22.00
March	15.00	17.50	18.00	19.00	15.00	18.00	20.50	21.50
April	16.00	19.50	18.50	22.00	15.00	20.50	21.00	25.00
May	18.50	23.50	22.50	26.50	17.00	22.00	24.40	30.00
June	20.00	23.50	21.00	26.50	19.00	24.50	26.00	29.00
July	22.00	25.00	19.00	25.50	18.00	29.00	26.00	28.00
August	19.00	24.00	21.50	25.50	18.00	23.50	27.00	28.00
September	18.00	22.00	20.00	23.00	20.00	25.00	22.50	25.00
October	19.00	22.00	22.00	23.50	21.00	25.00	22.50	25.00
November	20.50	22.00	22.00	24.00	19.00	25.50	25.00	26.00
December	20.00	22.00	23.00	24.50	21.50	26.00	24.50	25.50
Year	15.00	25.00	18.00	26.50	14.50	29.00	20.50	30.00

CLOVER AND TIMOTHY SEED.

Wholesale prices of clover and timothy seed, 1898–1911.

Date.	Clover (bushels of 60 pounds). Cincinnati. Prime. Low.	High.	Chicago. Poor to prime.[1] Low.	High.	Toledo. Poor to choice.[2] Low.	High.	Detroit. Low.	High.	Timothy. Cincinnati. Per bushel (of 45 pounds). Low.	High.	Chicago. Poor to choice (per 100 pounds).[2] Low.	High.	Milwaukee. Per 100 pounds. Low.	High.	St. Louis. Poor to prime (per 100 pounds). Low.	High.
1898	$2.45	$3.75	$0.60	$4.80	$2.80	$5.15	$2.80	$5.20	$0.95	$1.25	$2.15	$3.00	$1.50	$3.00	.....	.....
1899	2.75	4.50	.90	5.16	3.42½	6.80	3.40	6.50	.95	1.15	2.25	2.55	1.70	2.80	.....	.....
1900	4.00	6.00	2.40	6.30	4.95	7.85	4.80	7.10	1.03	2.00	2.32½	4.65	1.90	4.50	.....	.....
1901	4.50	6.60	2.40	6.90	5.15	7.40	5.15	7.35	1.70	2.90	3.35	6.55	3.00	6.25	.....	.....
1902	4.11	5.76	2.40	6.81	3.90	7.10	4.90	6.10	1.98	3.96	2.00	7.35	2.50	6.75	$2.40	$6.40
1903	5.00	7.10	2.40	7.50	3.05	7.70	6.45	7.50	1.20	1.70	1.75	4.35	2.00	3.75	2.00	3.60
1904	4.80	7.50	3.60	7.80	2.50	7.95	6.20	7.95	1.15	1.35	1.75	3.25	2.00	3.15	2.00	2.80
1905	5.70	7.75	4.80	8.64	3.00	8.85	6.30	8.75	1.15	1.60	1.50	3.75	2.25	3.50	2.00	3.70
1906	4.50	7.50	3.90	8.49	3.00	8.72½	6.25	8.70	1.30	1.85	2.00	4.50	2.40	4.25	2.40	4.00
1907	7.00	8.50	4.80	10.20	3.00	11.00	8.00	10.75	1.50	2.25	3.00	4.75	3.25	4.65	3.00	4.60
1908.																
January	7.50	10.00	6.00	11.25	6.25	11.40	10.25	11.20	1.75	2.15	4.35	4.55	3.75	4.40	3.50	4.50
February	7.50	10.00	7.20	11.76	6.65	11.77½	11.20	11.60	1.75	2.15	4.60	4.85	3.75	4.60	3.75	4.50
March	7.50	11.00	7.35	13.05	8.50	13.35	11.40	13.00	1.75	2.15	4.50	4.85	3.50	4.30	3.65	4.25
April	8.00	11.00	4.80	14.40	7.00	13.55	11.50	13.00	1.75	2.05	4.25	4.65	2.75	4.10	3.00	4.00
May	8.00	11.00	4.80	10.20	5.50	13.25	12.00	12.50	1.75	2.05	4.10	4.25	2.75	4.00	3.00	3.75
June	8.00	11.00	4.80	10.20	6.00	13.00	.....	.....	1.75	2.05	3.80	4.00	3.00	4.00	3.00	3.75
July	8.00	11.00	4.80	10.20	6.00	13.00	.....	.....	1.75	2.05	3.92½	4.10	3.25	4.00	3.00	3.50
August	5.50	6.00	4.20	10.20	5.20	13.00	.....	.....	1.65	2.05	3.60	3.80	2.85	3.75	3.00	4.00
September	4.50	5.50	4.50	6.00	4.75	5.95	5.50	5.60	1.50	1.65	3.25	3.75	2.50	3.50	2.00	3.50
October	4.00	5.50	3.60	5.70	3.90	5.60	4.60	5.60	1.35	1.65	3.40	3.75	2.50	3.25	2.25	3.35
November	4.00	5.00	3.60	5.70	4.00	5.65	5.00	5.60	1.35	1.55	3.75	4.60	2.50	3.50	2.50	3.35
December	4.00	5.00	3.90	5.67	4.40	5.72½	5.45	5.65	1.35	1.55	3.70	3.85	2.75	3.65	2.50	3.45
Year	4.00	11.00	3.60	14.40	3.90	13.55	4.60	13.00	1.35	2.15	3.25	4.85	2.50	4.60	2.00	4.50
1909.																
January	4.00	5.40	4.20	5.61	5.45	5.70	5.50	5.60	1.35	1.55	2.50	4.00	2.75	3.65	3.00	3.45
February	5.00	5.40	4.50	5.58	5.35	5.60	5.35	5.50	1.35	1.55	2.50	3.90	2.75	3.75	3.00	3.45
March	5.00	5.40	4.20	5.46	5.17½	5.60	5.20	5.45	1.35	1.55	2.50	3.85	2.60	3.80	2.50	3.52
April	5.00	5.40	4.20	5.85	5.55	6.10	5.40	6.10	1.35	1.55	2.50	3.80	2.50	3.80	2.25	3.52
May	5.00	5.40	4.35	5.82	5.70	5.95	5.75	5.85	1.35	1.55	2.50	4.00	2.50	3.75	1.50	3.50
June	5.00	5.40	4.35	6.36	6.00	6.65	6.00	6.10	1.35	1.55	2.50	3.90	2.50	3.75	2.75	3.25
July	5.00	5.40	4.62	6.51	6.50	6.75	.....	.....	1.35	1.55	2.50	3.90	2.50	3.75	2.75	3.25
August	5.00	6.00	4.20	7.02	6.70	7.25	6.65	7.00	1.35	1.55	2.50	3.80	2.50	3.50	2.50	3.70
September	5.80	8.25	4.95	8.25	7.10	9.55	7.00	9.25	1.35	1.65	2.50	4.00	2.50	3.50	2.50	3.55
October	8.00	8.50	5.40	9.00	8.80	9.35	8.85	9.15	1.40	1.65	2.50	4.00	2.50	3.75	2.50	3.60
November	8.00	8.50	5.40	8.70	8.52½	8.95	8.50	8.90	1.30	1.55	2.50	3.75	2.50	3.75	2.50	3.50
December	8.00	8.50	5.70	8.55	8.70	9.22½	8.70	9.15	1.30	1.55	2.50	3.75	2.90	3.60	2.50	3.50
Year	4.00	8.50	4.20	9.00	5.17½	9.55	5.20	9.25	1.30	1.65	2.50	4.00	2.50	3.80	1.50	3.70
1910.																
January	7.98	8.49	9.25	15.00	3.00	9.05	8.50	9.10	1.30	1.55	2.50	3.90	2.90	4.00	2.50	3.65
February	7.50	8.49	9.00	14.05	3.00	8.55	7.90	8.80	1.30	1.65	2.60	3.90	2.90	4.00	2.50	3.65
March	6.00	7.50	7.50	13.60	3.00	8.25	6.90	8.15	1.40	1.65	2.65	3.85	2.90	3.50	3.00	3.50
April	5.49	6.51	6.50	12.50	3.00	7.60	6.75	7.75	1.40	1.65	2.50	3.80	2.75	3.50	3.00	3.50
May	5.49	6.00	6.50	11.25	3.00	6.95	6.40	6.75	1.40	1.65	2.50	3.75	2.75	3.50	3.00	3.50
June	5.49	6.00	6.50	11.50	3.00	7.20	6.75	7.00	1.40	1.65	2.50	4.10	2.75	3.50	3.00	3.75
July	5.49	6.00	6.75	12.85	4.75	8.00	7.00	8.00	1.40	2.25	3.00	5.75	2.75	5.25	3.00	5.50
August	5.49	7.98	8.25	15.50	5.00	9.60	7.85	9.20	2.00	3.50	4.25	8.00	4.25	6.75	5.00	7.65
September	7.74	7.98	9.00	17.00	2.40	10.30	8.75	10.00	3.25	4.25	7.00	9.50	5.50	9.00	7.25	10.00
October	7.74	8.49	8.00	15.50	3.00	9.35	8.50	9.35	3.50	4.25	6.50	9.10	7.00	9.00	5.00	9.00
November	6.99	8.16	8.50	14.30	3.00	9.00	8.40	8.85	3.50	4.00	7.00	9.50	7.50	9.25	5.00	9.25
December	6.99	7.98	8.50	15.00	4.20	9.30	8.75	9.10	3.50	4.00	8.00	9.75	7.25	9.50	5.00	9.50
Year	5.49	8.49	6.50	17.00	2.40	10.30	6.40	10.00	1.30	4.25	2.50	9.75	2.75	9.50	2.50	9.50
1911.																
January	4.20	4.80	5.40	9.00	3.00	9.25	8.75	9.10	3.50	4.00	8.00	10.70	8.00	10.00	5.00	9.75
February	4.20	4.95	5.40	9.00	3.00	9.20	8.80	8.85	3.50	4.25	8.50	12.50	8.00	11.50	5.00	11.25
March	4.20	4.95	5.40	9.30	3.00	9.55	8.60	8.69	3.75	5.00	8.00	12.50	9.00	11.50	5.00	11.25
April	4.20	4.95	4.80	9.30	3.00	9.40	8.60	9.00	4.50	5.00	7.00	12.00	9.00	12.00	8.00	11.00
May	4.50	4.95	4.80	9.60	7.00	10.00	9.00	9.25	4.00	5.00	8.00	12.00	9.00	12.00	7.00	10.50
June	4.50	4.80	4.80	9.90	7.00	10.20	9.25	9.50	4.00	5.00	8.00	12.00	8.00	12.00	7.00	10.50
July	4.50	4.80	4.80	10.80	7.25	11.50	9.50	10.50	4.00	5.00	8.00	13.25	8.00	15.00	7.00	15.65
August	4.50	6.60	5.70	12.15	6.00	12.80	10.50	12.00	4.00	6.90	9.00	15.00	10.00	15.00	5.00	15.00
September	6.00	6.60	7.80	12.30	3.00	12.50	11.50	12.25	6.00	6.25	11.00	15.50	12.00	15.00	12.00	15.50
October	6.00	6.60	7.80	12.45	5.50	12.70	12.00	12.50	6.00	6.25	11.00	16.00	10.00	15.00	10.00	15.75
November	6.00	6.60	8.10	12.45	3.00	12.72½	12.25	12.40	6.00	6.25	10.00	16.25	10.00	15.25	10.00	15.75
December	6.00	6.60	7.80	12.45	7.00	12.75	12.10	12.50	6.00	6.25	10.00	16.25	10.00	15.50	10.00	15.75
Year	4.20	6.60	4.80	12.45	3.00	12.80	8.60	12.50	3.50	6.90	7.00	16.25	8.00	15.50	5.00	15.75

[1] Poor to choice, 1898 to 1904.

[2] Prime, 1902 to 1904.

COTTON.

Cotton crop of countries named, 1906–1910.

No statistics for Siam and some other less important cotton-growing countries. Bales of 500 pounds, gross weight, or 478 pounds, net.]

Country.	1906	1907	1908	1909	1910
NORTH AMERICA.					
United States:[1]	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Contiguous	13,273,809	11,107,179	13,241,799	10,004,949	11,608,616
Noncontiguous—Porto Rico	220	446	399	240	342
Total United States (except Philippine Islands)	13,274,029	11,107,625	13,242,198	10,005,189	11,608,958
Guatemala [2]	147	147	147	147	147
Mexico	270,000	[3] 70,000	[3] 140,000	[3] 200,000	[3] 200,000
Nicaragua [4]	12	[5] 12	[5] 12	[5] 12	....
West Indies:					
British—					
Bahamas [4]	27	18	27	25	[6] 13
Barbados	1,011	[4] 1,981	[4] 2,061	[4] 1,348	[4,6] 1,232
Grenada [4]	651	607	489	677	[6] 555
Jamaica [4]	40	13	43	46	[6] 28
Leeward Islands	[4] 986	1,954	[4] 2,248	1,443	[4,6] 1,496
St. Lucia [4]	2	....	....	13	....
St. Vincent [4]	550	895	880	733	[6] 1,092
Trinidad and Tobago	23	24	28	18	[6] 24
Cuba [4]	1	....	....	....	....
Danish [4]	[7] 505	[7] 505	505	557	[6] 572
French—					
Guadeloupe [4]	13	10	26	12	[8] 12
Martinique [4]	1	....	....	....	....
Haiti [4]	8,086	7,092	[8] 7,092	7,550	8,000
Total	13,556,084	11,190,883	13,395,756	10,217,770	11,822,129
SOUTH AMERICA.					
Argentina	[7] 2,000	[7] 2,000	[9] 2,000	[7] 2,000	[7] 2,000
Brazil [3]	365,000	348,000	231,000	265,000	270,000
British Guiana [4]	1	....	....	....	....
Chile [4]	1,357	1,134	979	788	708
Colombia and Venezuela [10]	5,000	5,000	5,000	5,000	5,000
Ecuador [4]	[11] 47	34	15	49	[8] 49
Peru	58,283	66,804	175,000	110,000	115,000
Paraguay [10]	200	200	200	200	200
Total	431,888	423,172	414,194	383,037	392,957
EUROPE.					
Bulgaria	874	604	691	783	1,137
Crete [10]	700	700	700	700	700
Greece	10,147	[10] 8,200	[10] 8,200	[10] 8,200	[10] 8,200
Italy [10]	2,700	2,700	2,700	2,700	2,700
Malta	348	443	364	379	411
Total	14,769	12,647	12,655	12,762	13,148
ASIA.					
British India, including native States [12]	4,487,000	3,591,000	3,997,000	4,374,895	3,874,477
Ceylon [4]	559	664	492	404	537
China [10]	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000

[1] "Linters," a by-product obtained in the oil mills, not included. Quantity of linters produced as follows: 321,689 bales in 1906, 265,282 in 1907, 343,507 in 1908, 310,433 in 1909, and 397,628 bales in 1910. For Porto Rico data refer to exports to foreign countries plus shipments to the United States.
[2] Official estimate for 1903.
[3] Unofficial estimate.
[4] Exports.
[5] Exports, 1906.
[6] Preliminary.
[7] Data for 1908.
[8] Year preceding.
[9] Estimate based upon census returns for acreage.
[10] Average production as unofficially estimated.
[11] Exports, 1905.
[12] Net exports and consumption.

COTTON—Continued.

Cotton crop of countries named, 1906–1910—Continued.

Country.	1906	1907	1908	1909	1910
ASIA—continued.	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Cyprus	3,361	4,110	3,860	3,436	[1] 1,688
Dutch East Indies [2]	15,944	19,652	19,932	13,235	[1] 12,321
French India [2]	....	....	....	8	[3] 8
French Indo-China [2]	11,082	15,877	20,968	14,138	[3] 14,138
Japan	9,238	8,195	6,437	16,889	7,400
Korea [4]	70,000	70,000	70,000	70,000	70,000
Persia [2]	91,431	89,689	83,985	128,031	[3] 128,031
Philippine Islands [5]	6,098	6,098	6,098	6,098	6,098
Russia, Asiatic:					
Central Asia [6]	627,063	486,192	494,000	372,000	642,000
Transcaucasia	60,440	62,553	52,000	46,000	[3] 46,000
Total, Asiatic Russia	687,503	548,745	546,000	418,000	688,000
Turkey [7]	[8] 141,000	[8] 141,000	[8] 141,000	141,000	[8] 141,000
Total	6,723,216	5,695,030	6,095,772	6,386,134	6,143,698
AFRICA.					
British Africa:					
Nyasaland Protectorate [2]	1,101	844	1,582	1,729	1,147
East Africa	214	167	526	297	341
Gold Coast [2]	194	117	108	65	24
Natal	42	[2] 40	(9)	(9)	(9)
Nigeria	6,385	8,556	4,800	10,529	5,185
Uganda [2]	819	4,024	3,401	5,429	11,584
Sierra Leone [2]	184	27	1	....	....
Union of South Africa [2]	....	....	82	159	91
Total, British Africa	8,939	13,775	10,500	18,208	18,372
Egypt	1,427,774	1,486,387	1,398,125	1,045,724	1,570,620
French Africa: [2]					
Algeria	8	73	163	200	700
Dahomey	....	428	342	600	553
Madagascar	333	1	4	2	[3] 2
Senegal	97	110	75	6	[3] 6
Upper Senegal and Niger			62	96	[3] 96
Somali Coast	9	7	3	7	[3] 7
Total, French Africa	447	619	649	911	1,364
German Africa: [2]					
East Africa	870	1,068	1,246	2,395	[3] 2,395
Kamerum	2	....	11	11	[3] 11
Toga	892	1,297	1,933	2,356	2,142
Total, German Africa	1,764	2,365	3,190	4,762	4,548
Italian Africa—Eritrea	....	370	890	636	[3] 636
Belgian Kongo [2]	1	3	1	....	1
Portuguese Africa:					
Angola [10]	256	425	241	420	[3] 420
East Africa	[11] 26	[2] 6	....	48	[3] 48
Total, Portuguese Africa	282	431	241	468	468
Sudan (Anglo-Egyptian)	17,782	28,558	24,170	[12] 24,170	[12] 24,170
Total	1,456,989	1,532,508	1,437,766	1,094,879	1,620,179
OCEANIA.					
British—Queensland	54	76	82	270	[1] 317
Fiji Islands [2]	....	6	7	....	4
French: [2]					
New Caledonia	....	....	3	16	[3] 16
French Establishments	110	109	70	332	[3] 332
German—Bismarck Archipelago [3]	38	5	....	....	....
Total	202	196	162	618	669
Grand total	22,183,148	18,854,436	21,356,305	18,095,200	19,992,780

1 Preliminary.
2 Exports.
3 Year preceding.
4 Average production as unofficially estimated.
5 Census, 1902.
6 Including Khiva and Bokhara.
7 Data for European and Asiatic Turkey includes 29 provinces and arrondissements only.
8 Data for 1909.
9 Included in Union of South Africa.
10 Imports from Angola into Portugal.
11 Data for 1905.
12 Data for 1908.

COTTON—Continued.

Cotton acreage (harvested), by States, 1906–1911.

[As reported by Bureau of Statistics, Department of Agriculture.]

State or Territory.	1906	1907	1908	1909	1910	1911
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Virginia	36,000	35,000	28,000	25,000	33,000	43,000
North Carolina	1,374,000	1,408,000	1,458,000	1,359,000	1,478,000	1,624,000
South Carolina	2,389,000	2,426,000	2,545,000	2,492,000	2,534,000	2,800,000
Georgia	4,610,000	4,774,000	4,848,000	4,674,000	4,873,000	5,504,000
Florida	283,000	265,000	265,000	237,000	257,000	308,000
Alabama	3,658,000	3,439,000	3,591,000	3,471,000	3,560,000	4,017,000
Mississippi	3,408,000	3,220,000	3,395,000	3,291,000	3,317,000	3,340,000
Louisiana	1,739,000	1,622,000	1,550,000	930,000	975,000	1,075,000
Texas	8,894,000	9,156,000	9,316,000	9,660,000	10,060,000	10,943,000
Arkansas	2,097,000	1,950,000	2,296,000	2,218,000	2,238,000	2,363,000
Tennessee	814,000	749,000	754,000	735,000	765,000	837,000
Missouri	91,000	71,000	87,000	79,000	100,000	129,000
Oklahoma	1,080,000	} 2,196,000	2,311,000	1,767,000	2,204,000	3,050,000
Indian Territory	901,000					
California	....	....	....	....	9,000	12,000
United States	31,374,000	31,311,000	32,444,000	30,938,000	32,403,000	36,045,000

Production of lint cotton (excluding linters) in 500-pound gross weight bales, by States and total value of crop, 1906 to 1911.

[As finally reported by U. S. Bureau of the Census.]

State or Territory.	1906	1907	1908	1909	1910	1911
	Bales.	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Virginia	13,862	9,223	12,326	10,095	14,815	29,891
North Carolina	579,326	605,310	646,958	600,606	706,142	1,075,826
South Carolina	876,181	1,119,220	1,170,608	1,099,955	1,163,501	1,648,712
Georgia	1,592,572	1,815,834	1,931,179	1,804,014	1,767,202	2,768,627
Florida	55,945	49,794	62,089	54,011	58,949	83,388
Alabama	1,261,522	1,112,698	1,345,713	1,024,350	1,194,250	1,716,534
Mississippi	1,530,748	1,468,177	1,655,945	1,083,215	1,262,680	1,203,545
Louisiana	987,779	675,428	470,136	253,412	245,648	384,597
Texas	4,174,206	2,300,179	3,814,485	2,522,811	3,049,409	4,256,427
Arkansas	941,177	774,721	1,032,920	713,463	821,233	939,302
Tennessee	306,037	275,235	344,485	246,630	331,947	449,737
Missouri	54,358	36,243	61,907	45,141	59,633	96,808
Oklahoma	487,306	} 862,383	690,752	544,954	923,063	1,022,092
Indian Territory	410,520					
All other	2,270	2,734	2,296	2,292	10,144	17,215
United States	13,273,809	11,107,179	13,241,799	10,004,949	11,608,616	15,692,701
Total value of crop.	$640,310,000	$613,630,000	$588,810,000	$688,350,000	$820,320,000	....

Condition of the cotton crop in the United States, monthly, and average yield per acre, 1890–1911.

Year.	June.	July.	August.	September.	October.	Average yield per acre (lint).	Year.	June.	July.	August.	September.	October.	Average yield per acre (lint).
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*
1890	88.8	91.4	89.5	85.5	80.0	187.0	1901	81.5	81.1	77.2	71.4	61.4	169.0
1891	85.7	88.6	88.9	82.7	75.7	179.4	1902	95.1	84.7	81.9	64.0	58.3	188.5
1892	85.9	86.9	82.3	76.8	73.3	209.2	1903	74.1	77.1	79.7	81.2	65.1	174.5
1893	85.6	82.7	80.4	73.4	70.7	148.8	1904	83.0	88.0	91.6	84.1	75.8	204.9
1894	88.3	89.6	91.8	85.9	82.7	191.7	1905	77.2	77.0	74.9	72.1	71.2	186.1
1895	81.0	82.3	77.9	70.8	65.1	155.6	1906	84.6	83.3	82.9	77.3	71.6	202.5
1896	97.2	92.5	80.1	64.2	60.7	124.1	1907	70.5	72.0	75.0	72.7	67.7	178.3
1897	83.5	86.0	86.9	78.3	70.0	181.9	1908	79.7	81.2	83.0	76.1	69.7	194.9
1898	89.0	91.2	91.2	79.8	75.4	219.0	1909	81.1	74.6	71.9	63.7	58.5	154.3
1899	85.7	87.8	84.0	68.5	62.4	184.1	1910	82.0	80.7	75.5	72.1	65.9	170.7
1900	82.5	75.8	76.0	68.2	67.0	194.4	1911	87.8	88.2	89.1	73.2	71.1	208.2

COTTON—Continued.

Average yield per acre and farm price per pound of cotton in the United States.

States.	Yield per acre.						Farm price per pound.							
	10-year averages.				1910	1911	10-year averages, Dec. 1.			Dec. 1, 1910.	Quarterly, 1911.			
	1870-1879.	1880-1889.	1890-1899.	1900-1909.			1880-1889.	1890-1899.	1900-1909.		Mar. 1.	June 1.	Sept. 1.	Dec. 1.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Virginia	175	157	155	197	212	330	8.8	7.1	9.6	13.8	13.8	14.0	12.8	9.0
North Carolina	167	166	182	209	227	315	9.0	7.2	9.8	14.1	13.9	14.8	12.1	8.8
South Carolina	159	154	170	194	216	280	9.1	7.2	9.9	14.2	14.0	15.0	11.8	8.8
Georgia	152	146	156	180	173	240	9.1	7.0	9.9	14.2	14.0	14.9	11.9	8.9
Florida	113	109	108	123	110	130	10.3	7.7	12.8	21.0	19.6	18.0	14.8	12.0
Alabama	149	143	155	162	160	204	9.0	7.0	9.7	14.2	14.0	14.8	11.8	8.8
Mississippi	176	181	188	204	182	172	9.0	6.9	9.8	14.4	13.9	14.8	11.5	9.2
Louisiana	195	215	222	217	120	170	9.0	7.0	9.6	14.4	14.0	14.4	11.6	8.9
Texas	211	187	188	170	145	186	8.6	6.8	9.4	14.0	13.9	14.3	11.6	8.6
Arkansas	213	213	208	202	175	190	8.9	6.9	9.6	14.4	13.6	14.3	12.0	8.9
Tennessee	189	167	165	192	207	257	8.8	6.9	9.6	14.1	13.8	14.2	12.1	8.8
Missouri	214	170	195	279	285	360	8.8	7.1	9.1	13.0	12.3	14.0	11.5	8.8
Oklahoma	.....	.....	211	216	200	160	.....	6.6	9.2	13.3	13.5	13.6	11.6	8.0
California	.....	.....	.....	.....	335	390	.....	.....	.....	13.3	13.5	.....	11.0	7.5
United States	176.5	169.4	178.1	184.7	170.7	207.7	9.0	6.9	9.7	14.2	13.9	14.6	11.8	8.8

Average farm price of cotton per pound on the first of each month, 1910–1911.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	14.4	14.6	......	......	14.4	14.9	......	......	14.0	14.1	14.4	14.4	13.5	......
February	14.3	14.0	......	......	14.5	14.2	......	......	13.5	14.0	14.2	13.9	13.7	......
March	13.9	14.0	......	......	14.1	14.3	......	......	12.3	14.2	13.8	13.8	13.5	......
April	13.9	14.1	......	......	14.3	14.5	......	......	13.0	13.0	13.8	13.9	......	......
May	14.2	14.0	......	......	14.6	14.3	......	......	13.0	11.8	14.1	13.8	......	......
June	14.6	14.2	......	......	15.0	14.6	......	......	14.0	13.3	14.4	13.9	......	......
July	14.4	13.9	......	......	14.8	14.2	......	......	12.7	12.1	14.2	13.7	......	......
August	13.2	14.3	......	......	13.7	14.8	......	......	11.9	12.3	13.1	14.0	......	......
September	11.8	14.4	......	......	12.0	14.8	......	......	11.5	12.7	11.7	14.2	11.0	......
October	10.2	13.3	......	......	10.1	13.4	......	......	10.0	13.5	10.3	13.2	......	12.5
November	8.9	14.0	......	......	8.9	14.0	......	......	9.5	12.5	8.9	14.0	......	14.0
December	8.8	14.2	......	......	8.9	14.3	......	......	8.8	13.0	8.7	14.1	7.5	13.3

Closing prices of middling Upland cotton per pound, 1898–1911.

Date.	New York.		New Orleans.		Memphis.		Galveston.		Savannah.		Charleston.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
1898	$5\frac{5}{16}$	$6\frac{7}{8}$	$4\frac{3}{4}$	$6\frac{1}{16}$	$4\frac{7}{8}$	6	$4\frac{7}{8}$	$6\frac{1}{16}$	$4\frac{1}{2}$	6	$4\frac{9}{16}$	6
1899	$6\frac{1}{8}$	$7\frac{13}{16}$	$5\frac{3}{16}$	$7\frac{1}{2}$	$5\frac{3}{8}$	$7\frac{1}{2}$	$5\frac{7}{16}$	$7\frac{1}{2}$	$5\frac{1}{16}$	$7\frac{5}{16}$	$5\frac{1}{8}$	$7\frac{3}{8}$
1900	$7\frac{1}{4}$	11	$7\frac{1}{4}$	$11\frac{1}{8}$	$7\frac{3}{8}$	11	$7\frac{1}{4}$	10	$7\frac{5}{16}$	$10\frac{3}{4}$	$7\frac{1}{4}$	$10\frac{3}{4}$
1901	7	12	$7\frac{1}{4}$	$9\frac{11}{16}$	$7\frac{1}{8}$	$9\frac{5}{8}$	$7\frac{3}{8}$	$9\frac{11}{16}$	$7\frac{1}{8}$	$9\frac{5}{8}$	$7\frac{1}{8}$	$9\frac{7}{8}$
1902	$8\frac{3}{16}$	$9\frac{7}{8}$	$7\frac{5}{8}$	$9\frac{3}{4}$	7	$9\frac{1}{2}$	$7\frac{3}{4}$	$9\frac{5}{8}$	$7\frac{9}{16}$	$9\frac{9}{16}$	$7\frac{3}{16}$	$9\frac{3}{8}$
1903	8.85	14.10	$8\frac{7}{16}$	$13\frac{5}{8}$	$8\frac{1}{2}$	$13\frac{1}{2}$	$8\frac{5}{8}$	$13\frac{3}{8}$	$8\frac{3}{8}$	$13\frac{3}{8}$	$8\frac{1}{4}$	$13\frac{1}{2}$
1904	6.85	17.25	$6\frac{1}{2}$	$16\frac{7}{16}$	$6\frac{3}{4}$	$16\frac{1}{2}$	$6\frac{5}{8}$	16	$6\frac{1}{2}$	$16\frac{1}{4}$	$6\frac{1}{2}$	16
1905	7.00	12.60	$6\frac{5}{8}$	$12\frac{1}{16}$	$6\frac{3}{4}$	$12\frac{1}{8}$	$6\frac{3}{4}$	12	$6\frac{5}{8}$	$11\frac{11}{16}$	$6\frac{5}{8}$	$11\frac{5}{16}$
1906	9.60	12.25	$9\frac{3}{8}$	$11\frac{11}{16}$	$9\frac{3}{8}$	$11\frac{11}{16}$	$9\frac{1}{4}$	$11\frac{9}{16}$	$8\frac{7}{8}$	$11\frac{3}{4}$	$8\frac{3}{4}$	$11\frac{3}{8}$
1907	10.60	13.55	$10\frac{1}{4}$	$13\frac{9}{16}$	$10\frac{1}{4}$	$13\frac{1}{2}$	$10\frac{1}{2}$	$13\frac{9}{16}$	$9\frac{7}{8}$	$13\frac{5}{16}$	$9\frac{3}{4}$	13

COTTON—Continued.

Closing prices of middling Upland cotton per pound, 1898–1911—Continued.

Date.	New York.		New Orleans.		Memphis.		Galveston		Savannah.		Charleston.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1908.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	11.30	12.25	$11\frac{3}{8}$	$12\frac{1}{4}$	$11\frac{1}{2}$	$12\frac{3}{8}$	$11\frac{3}{8}$	$12\frac{1}{4}$	$10\frac{9}{16}$	$11\frac{5}{8}$	$10\frac{5}{8}$	$11\frac{1}{2}$
February	11.35	11.85	$11\frac{3}{8}$	$11\frac{7}{8}$	$11\frac{5}{8}$	$11\frac{15}{16}$	$11\frac{3}{8}$	$11\frac{7}{8}$	11	$11\frac{3}{8}$	11	$11\frac{1}{4}$
March	10.40	11.65	$10\frac{1}{2}$	$11\frac{3}{8}$	$10\frac{3}{4}$	$11\frac{5}{8}$	$10\frac{1}{2}$	$11\frac{7}{16}$	$10\frac{1}{8}$	$11\frac{1}{8}$	10	11
April	9.90	10.50	$9\frac{13}{16}$	$10\frac{1}{2}$	$9\frac{3}{4}$	$10\frac{3}{4}$	$9\frac{3}{4}$	$10\frac{1}{2}$	$9\frac{3}{4}$	$10\frac{1}{8}$	11	11
May	10.20	11.50	$9\frac{15}{16}$	$11\frac{1}{2}$	10	$11\frac{5}{8}$	$10\frac{3}{8}$	$11\frac{3}{4}$	$9\frac{3}{4}$	$11\frac{1}{2}$	$9\frac{3}{4}$	$11\frac{1}{4}$
June	11.30	12.20	$11\frac{3}{8}$	$11\frac{7}{8}$	$11\frac{1}{2}$	$11\frac{3}{4}$	$11\frac{9}{16}$	$11\frac{7}{8}$	$11\frac{1}{8}$	$11\frac{5}{8}$	11	$11\frac{5}{8}$
July	10.70	11.50	$10\frac{3}{8}$	$11\frac{3}{8}$	$10\frac{1}{2}$	$11\frac{5}{8}$	$10\frac{1}{4}$	$11\frac{3}{8}$	$10\frac{3}{8}$	$11\frac{1}{8}$	$10\frac{3}{8}$	11
August	9.50	10.85	$9\frac{1}{8}$	$10\frac{3}{8}$	$9\frac{5}{8}$	$10\frac{1}{2}$	$9\frac{1}{8}$	$10\frac{7}{16}$	9	$10\frac{1}{2}$	9	$10\frac{1}{2}$
September	9.30	9.60	9	$9\frac{3}{16}$	$9\frac{1}{8}$	$9\frac{5}{8}$	$9\frac{3}{16}$	$9\frac{7}{16}$	$8\frac{3}{4}$	$9\frac{1}{8}$	$8\frac{3}{4}$	9
October	9.00	9.45	$8\frac{3}{4}$	9	$8\frac{7}{8}$	$9\frac{1}{8}$	9	$9\frac{3}{16}$	$8\frac{1}{2}$	$8\frac{15}{16}$	$8\frac{1}{2}$	$8\frac{15}{16}$
November	9.25	9.55	$8\frac{7}{8}$	$9\frac{1}{16}$	$9\frac{1}{8}$	$9\frac{1}{4}$	9	$9\frac{3}{16}$	$8\frac{3}{4}$	9	$8\frac{3}{4}$	$8\frac{15}{16}$
December	9.10	9.35	$8\frac{11}{16}$	$8\frac{15}{16}$	$8\frac{3}{4}$	$9\frac{1}{8}$	$8\frac{3}{4}$	9	$8\frac{1}{4}$	$8\frac{11}{16}$	$8\frac{1}{4}$	$8\frac{3}{4}$
Year	9.00	12.25	$8\frac{11}{16}$	$12\frac{1}{4}$	$8\frac{3}{4}$	$12\frac{3}{8}$	$8\frac{3}{4}$	$12\frac{1}{4}$	$8\frac{1}{4}$	$11\frac{5}{8}$	$8\frac{1}{4}$	$11\frac{5}{8}$
1909.												
January	9.25	10.00	$8\frac{7}{8}$	$9\frac{5}{8}$	9	$9\frac{1}{2}$	9	$9\frac{7}{8}$	$8\frac{11}{16}$	$9\frac{9}{16}$	$8\frac{3}{4}$	$9\frac{5}{16}$
February	9.65	10.00	$9\frac{5}{16}$	$9\frac{1}{2}$	$9\frac{5}{16}$	$9\frac{3}{8}$	$9\frac{7}{16}$	$9\frac{3}{4}$	$9\frac{3}{16}$	$9\frac{7}{16}$	9	$9\frac{3}{16}$
March	9.60	9.85	$9\frac{1}{4}$	$9\frac{1}{2}$	$9\frac{5}{16}$	$9\frac{7}{16}$	$9\frac{3}{8}$	$9\frac{9}{16}$	$9\frac{1}{16}$	$9\frac{5}{16}$	9	$9\frac{3}{16}$
April	9.95	10.90	$9\frac{7}{16}$	$10\frac{5}{16}$	$9\frac{3}{4}$	$10\frac{1}{4}$	$9\frac{9}{16}$	$10\frac{3}{8}$	$9\frac{3}{16}$	$10\frac{1}{16}$	$9\frac{1}{4}$	$10\frac{1}{16}$
May	10.85	11.80	$10\frac{3}{16}$	11	$10\frac{3}{16}$	$10\frac{7}{8}$	$10\frac{3}{8}$	$10\frac{7}{8}$	$10\frac{1}{16}$	$10\frac{7}{8}$	10	$10\frac{13}{16}$
June	11.20	12.00	$10\frac{7}{8}$	$11\frac{1}{2}$	$10\frac{7}{8}$	$11\frac{3}{8}$	$10\frac{5}{8}$	$11\frac{1}{4}$	$10\frac{3}{4}$	$11\frac{3}{8}$	......	......
July	12.10	13.15	$11\frac{1}{2}$	$12\frac{5}{8}$	$11\frac{7}{16}$	$12\frac{3}{8}$	$11\frac{3}{8}$	$12\frac{1}{2}$	$11\frac{3}{8}$	$12\frac{5}{8}$	......	......
August	12.40	13.10	$12\frac{1}{8}$	$12\frac{1}{2}$	12	$12\frac{3}{8}$	12	$12\frac{3}{8}$	12	$12\frac{1}{2}$	......	......
September	12.40	13.75	$12\frac{3}{16}$	$13\frac{3}{16}$	$12\frac{3}{8}$	$13\frac{1}{4}$	$12\frac{3}{16}$	$13\frac{3}{16}$	12	$13\frac{1}{16}$	$11\frac{7}{8}$	13
October	13.30	15.05	13	$14\frac{7}{16}$	$13\frac{1}{4}$	$14\frac{3}{4}$	13	$14\frac{7}{16}$	$12\frac{3}{4}$	$14\frac{3}{8}$	$12\frac{1}{4}$	$14\frac{3}{16}$
November	14.20	15.20	$14\frac{1}{8}$	$14\frac{11}{16}$	$14\frac{5}{8}$	15	$13\frac{7}{8}$	$14\frac{5}{8}$	$13\frac{3}{4}$	$14\frac{5}{8}$	14	$14\frac{5}{16}$
December	14.65	16.15	$14\frac{1}{4}$	$15\frac{3}{4}$	$14\frac{5}{8}$	$15\frac{5}{8}$	$14\frac{1}{4}$	$15\frac{3}{4}$	$14\frac{1}{8}$	$15\frac{7}{8}$	$14\frac{1}{2}$	$15\frac{3}{16}$
Year	9.25	16.15	$8\frac{7}{8}$	$15\frac{3}{4}$	9	$15\frac{5}{8}$	9	$15\frac{3}{4}$	$8\frac{11}{16}$	$15\frac{7}{8}$	$8\frac{3}{4}$	$15\frac{3}{16}$
1910.												
January	13.85	16.10	$14\frac{7}{8}$	$15\frac{3}{4}$	$15\frac{1}{4}$	$15\frac{5}{8}$	$14\frac{3}{4}$	$15\frac{3}{4}$	$14\frac{5}{8}$	$15\frac{1}{2}$	$15\frac{1}{4}$	$15\frac{5}{8}$
February	14.10	15.25	$14\frac{5}{8}$	$15\frac{1}{16}$	15	$15\frac{3}{8}$	$14\frac{3}{4}$	15	$14\frac{5}{8}$	$15\frac{1}{16}$	$14\frac{3}{8}$	15
March	14.65	15.35	$14\frac{9}{16}$	$14\frac{3}{16}$	15	15	$14\frac{3}{4}$	$14\frac{7}{8}$	$14\frac{11}{16}$	$14\frac{3}{4}$	$14\frac{5}{8}$	$14\frac{3}{4}$
April	14.55	15.30	$14\frac{9}{16}$	$14\frac{13}{16}$	$14\frac{3}{4}$	$14\frac{7}{8}$	$14\frac{7}{16}$	$14\frac{3}{4}$	$14\frac{1}{2}$	$14\frac{3}{4}$	14	$14\frac{3}{4}$
May	14.50	16.05	$14\frac{5}{8}$	$15\frac{1}{8}$	$14\frac{7}{8}$	$15\frac{1}{8}$	$14\frac{5}{8}$	$15\frac{1}{8}$	$14\frac{1}{2}$	$15\frac{1}{8}$	$14\frac{3}{8}$	15
June	14.50	15.40	$14\frac{1}{2}$	15	$14\frac{7}{8}$	15	$14\frac{1}{2}$	15	$14\frac{5}{8}$	$14\frac{7}{8}$	......	......
July	15.25	16.45	$14\frac{5}{8}$	$15\frac{3}{16}$	$14\frac{7}{8}$	$15\frac{1}{8}$	$14\frac{5}{8}$	$15\frac{7}{8}$	$14\frac{13}{16}$	$15\frac{5}{8}$	......	......
August	15.20	19.75	$14\frac{5}{8}$	$15\frac{1}{4}$	15	$15\frac{5}{8}$	$14\frac{3}{8}$	$15\frac{1}{8}$	$14\frac{3}{8}$	$15\frac{1}{2}$	......	......
September	13.60	15.50	$13\frac{1}{4}$	$14\frac{1}{4}$	$13\frac{1}{2}$	$14\frac{7}{8}$	$13\frac{3}{8}$	$14\frac{1}{8}$	$13\frac{3}{16}$	$14\frac{1}{4}$	13	14
October	13.75	14.90	$13\frac{9}{16}$	$14\frac{5}{8}$	$13\frac{7}{8}$	$14\frac{7}{8}$	14	$14\frac{3}{4}$	$13\frac{9}{16}$	$14\frac{11}{16}$	$13\frac{5}{16}$	$14\frac{5}{8}$
November	14.55	15.15	$14\frac{3}{16}$	$14\frac{3}{4}$	$14\frac{3}{8}$	$15\frac{1}{8}$	$14\frac{3}{8}$	15	$13\frac{15}{16}$	$14\frac{5}{8}$	14	$14\frac{5}{8}$
December	14.80	15.25	$14\frac{11}{16}$	$14\frac{15}{16}$	$15\frac{1}{8}$	$15\frac{3}{8}$	$14\frac{7}{8}$	15	$14\frac{3}{8}$	$14\frac{11}{16}$	$14\frac{3}{8}$	$14\frac{3}{4}$
Year	13.60	19.75	$13\frac{1}{4}$	$15\frac{3}{4}$	$13\frac{1}{2}$	$15\frac{5}{8}$	$13\frac{3}{8}$	$15\frac{7}{8}$	$13\frac{3}{16}$	$15\frac{5}{8}$	13	$15\frac{5}{8}$
1911.												
January	14.75	15.00	$14\frac{15}{16}$	15	$15\frac{1}{8}$	$15\frac{3}{8}$	$14\frac{15}{16}$	15	$14\frac{5}{8}$	$14\frac{3}{4}$	$14\frac{1}{2}$	$14\frac{5}{8}$
February	14.00	14.95	$14\frac{7}{16}$	$14\frac{15}{16}$	$14\frac{3}{4}$	$15\frac{1}{4}$	$14\frac{3}{8}$	15	$14\frac{5}{8}$	$14\frac{3}{4}$	$14\frac{1}{2}$	$14\frac{5}{8}$
March	14.20	14.65	$14\frac{3}{8}$	$14\frac{5}{8}$	$14\frac{3}{4}$	15	$14\frac{3}{8}$	$14\frac{3}{4}$	$14\frac{1}{4}$	$14\frac{5}{8}$	......	......
April	14.40	15.45	$14\frac{3}{8}$	$15\frac{1}{4}$	$14\frac{3}{4}$	$15\frac{1}{4}$	$14\frac{3}{8}$	$15\frac{5}{16}$	$14\frac{1}{4}$	$15\frac{1}{8}$	......	......
May	15.35	16.15	$15\frac{1}{4}$	$15\frac{11}{16}$	$15\frac{1}{4}$	$15\frac{3}{8}$	$15\frac{1}{4}$	$15\frac{5}{8}$	$15\frac{1}{8}$	$15\frac{3}{8}$	$15\frac{1}{4}$	$15\frac{5}{8}$
June	14.75	15.95	15	$15\frac{7}{16}$	15	$15\frac{7}{16}$	15	$15\frac{7}{16}$	$15\frac{1}{16}$	$15\frac{1}{2}$	$15\frac{3}{8}$	$15\frac{3}{8}$
July	12.50	14.85	$12\frac{3}{8}$	$15\frac{1}{16}$	13	15	$12\frac{1}{8}$	15	$13\frac{3}{8}$	$15\frac{1}{16}$	......	......
August	11.60	13.15	$11\frac{1}{2}$	$12\frac{1}{8}$	$12\frac{3}{4}$	13	$11\frac{3}{4}$	$12\frac{3}{8}$	$11\frac{5}{8}$	$13\frac{1}{8}$	......	......
September	10.35	12.00	$10\frac{9}{16}$	$11\frac{7}{8}$	$10\frac{3}{4}$	$12\frac{3}{4}$	$10\frac{1}{2}$	$12\frac{1}{16}$	$9\frac{15}{16}$	$12\frac{1}{16}$	$9\frac{3}{4}$	$11\frac{7}{8}$
October	9.35	10.20	$9\frac{3}{8}$	$10\frac{3}{16}$	$9\frac{3}{4}$	$10\frac{1}{2}$	$9\frac{3}{8}$	$10\frac{1}{4}$	$8\frac{7}{8}$	$9\frac{13}{16}$	$8\frac{3}{4}$	$9\frac{3}{4}$
November	9.30	9.60	$9\frac{1}{4}$	$9\frac{1}{2}$	$9\frac{1}{2}$	$9\frac{3}{4}$	$9\frac{1}{2}$	$9\frac{5}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$	$8\frac{7}{8}$	$9\frac{1}{8}$
December	9.20	9.65	$9\frac{1}{16}$	$9\frac{1}{4}$	$9\frac{1}{4}$	$9\frac{3}{8}$	$9\frac{1}{4}$	$9\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{15}{16}$	$8\frac{3}{4}$	$8\frac{7}{8}$
Year	9.20	16.15	$9\frac{1}{16}$	$15\frac{11}{16}$	$9\frac{1}{4}$	$15\frac{7}{16}$	$9\frac{1}{4}$	$15\frac{5}{8}$	$8\frac{5}{8}$	$15\frac{1}{2}$	$8\frac{3}{4}$	$15\frac{5}{8}$

COTTON—Continued.

International trade in cotton, 1906–1910.[1]

[Bales of 500 pounds, gross weight, 478 pounds of lint, net.]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Bales.	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Brazil	Jan. 1	146,060	129,308	16,441	45,974	51,471
British India	Jan. 1	1,625,261	2,214,504	1,423,692	1,795,846	2,354,852
China	Jan. 1	214,656	275,608	171,132	176,761	347,923
Egypt	Jan. 1	1,387,636	1,421,818	1,315,968	1,426,102	1,232,657
France	Jan. 1	169,840	193,357	213,791	270,387	411,101
Germany [2]	Jan. 1	181,056	269,548	248,768	255,294	231,039
Netherlands	Jan. 1	105,827	111,005	108,262	134,994	140,922
Persia	Mar. 21	91,431	89,689	83,985	128,031	[3] 128,031
Peru	Jan. 1	48,174	56,910	73,884	98,262	[3] 98,262
United States	Jan. 1	7,700,458	8,384,108	8,749,379	7,790,900	7,289,806
Other countries	....	137,225	160,971	118,000	128,000	[4] 138,000
Total	....	11,807,624	13,306,826	12,523,302	12,250,551	12,424,064

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Austria-Hungary	Jan. 1	762,887	928,097	816,444	866,981	783,531
Belgium	Jan. 1	249,285	287,095	226,183	308,583	290,104
Canada	Jan. 1	144,484	131,737	125,546	58,181	139,113
France	Jan. 1	1,124,520	1,258,161	1,294,295	1,469,837	1,178,168
Germany [2]	Jan. 1	1,895,837	2,323,684	2,189,209	2,235,384	1,967,955
Italy	Jan. 1	844,118	1,005,293	953,538	880,187	804,842
Japan	Jan. 1	842,749	1,139,993	890,132	1,071,801	1,350,246
Mexico	Jan. 1	15,670	3,820	7,611	59,071	10,750
Netherlands	Jan. 1	208,638	245,315	243,184	238,003	233,835
Russia	Jan. 1	757,035	821,027	1,100,041	847,799	[4] 914,304
Spain	Jan. 1	401,409	422,331	437,752	325,486	334,877
Sweden	Jan. 1	95,207	95,208	97,755	79,746	95,378
Switzerland	Jan. 1	109,592	118,430	107,309	109,590	96,574
United Kingdom	Jan. 1	3,686,006	4,302,404	3,702,357	4,017,004	3,591,298
United States	Jan. 1	137,415	236,293	154,662	193,940	178,409
Other countries	....	257,894	299,007	309,000	297,000	[4] 293,000
Total	....	11,532,746	13,617,895	12,655,018	13,058,593	12,262,384

[1] See "General note," p. 526.
[2] Not including free ports prior to Mar. 1, 1906.
[3] Year preceding.
[4] Preliminary.

International trade in cottonseed oil, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
Belgium	Jan. 1	1,218,611	1,371,671	1,248,975	1,096,092	935,857
Egypt	Jan. 1	360,883	214,732	231,564	396,982	515,466
France	Jan. 1	602,856	543,110	681,400	775,167	301,942
Netherlands	Jan. 1	108,062	74,686	267,693	44,409	103,205
United Kingdom	Jan. 1	7,654,982	8,402,909	8,595,491	6,506,155	8,933,717
United States	Jan. 1	40,297,852	39,115,276	48,930,381	45,514,435	23,550,468
Other countries	....	4,735	4,089	44,000	49,000	[2] 63,000
Total	....	50,247,981	49,726,473	59,999,504	54,382,240	34,403,655

[1] See "General note," p. 526.

COTTON—Continued.

International trade in cottonseed oil, 1906-1910—Continued.

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
Algeria	Jan. 1	1,091,215	1,106,262	961,213	[1] 1,326,677	[1] 128,128
Australia	Jan. 1	54,094	70,339	133,737	118,632	113,446
Austria-Hungary	Jan. 1	5,866,528	9,391	219,463	30,306	6,437
Belgium	Jan. 1	2,698,477	2,680,250	2,201,913	2,207,083	1,831,134
Brazil	Jan. 1	947,023	1,189,127	892,363	669,888	[2] 669,888
Canada	Jan. 1	1,411,152	1,684,614	1,558,995	2,113,687	3,128,710
Egypt	Jan. 1	153,722	51,674	740,987	489,737	145,618
France	Jan. 1	9,859,577	8,971,580	12,314,045	6,479,378	1,159,651
Germany [3]	Jan. 1	16,203,800	15,109,019	12,617,710	10,093,188	5,418,848
Italy	Jan. 1	786,563	902,692	3,095,547	9,002,322	1,052,358
Malta	Apr. 1	224,712	192,520	241,726	291,316	[2] 291,316
Martinique	Jan. 1	301,430	289,058	319,643	323,531	[2] 323,531
Mexico	Jan. 1	3,881,825	3,809,854	4,372,063	5,489,939	3,692,532
Netherlands	Jan. 1	5,418,951	5,950,945	5,984,030	4,432,512	3,971,079
Senegal	Jan. 1	352,461	370,617	355,962	411,509	[2] 411,509
United Kingdom	Jan. 1	3,224,727	3,922,618	4,584,145	4,893,653	4,665,472
Uruguay	July 1	304,092	[4] 304,092	383,332	[5] 383,332	[5] 383,332
Other countries	....	3,092,742	3,670,815	6,279,000	5,921,000	[1] 6,148,000
Total	....	55,873,091	50,285,467	57,255,874	54,677,690	33,540,989

[1] Preliminary.
[2] Year preceding.
[3] Not including free ports prior to Mar. 1, 1906.
[4] Data for 1906.
[5] Data for 1908.

TOBACCO.

Tobacco crop of countries named, 1906-1910.

Country.	1906	1907	1908	1909	1910
NORTH AMERICA.					
United States:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Contiguous	682,429,000	698,126,000	718,061,000	1,055,765,000	1,103,415,000
Noncontiguous—Porto Rico.[1]	8,000,000	13,000,000	10,000,000	10,000,000	10,000,000
Total United States (except Philippine Islands).	690,429,000	711,126,000	728,061,000	1,065,765,000	1,113,415,000
Canada:					
Ontario	7,575,000	(2)	[1] 3,504,000	5,610,000	8,750,000
Quebec	3,750,000	[1] 3,000,000	[1] 7,656,000	[3] 7,656,000	[3] 7,656,000
Other [4]	107,000	107,000	107,000	107,000	107,000
Total Canada	11,432,000	3,107,000	11,267,000	13,373,000	16,513,000
Cuba [1]	28,629,000	55,603,000	66,650,000	59,323,000	46,081,000
Guatemala [5]	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000
Mexico	34,711,000	[6] 34,711,000	[6] 34,711,000	[6] 34,711,000	[6] 34,711,000
Santo Domingo	[1] 30,600,000	26,400,000	[1] 32,500,000	30,000,000	42,000,000
Total	797,101,000	832,247,000	874,489,000	1,204,472,000	1,254,020,000
SOUTH AMERICA.					
Argentina	[5] 31,000,000	[5] 31,000,000	[7] 31,200,000	[5] 31,000,000	[5] 31,000,000
Bolivia [5]	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Brazil [8]	52,095,000	65,460,000	32,130,000	64,654,000	75,285,000
Chile	[5] 6,000,000	[5] 6,000,000	9,067,000	2,984,000	[9] 2,984,000
Ecuador	[10] 122,000	[8] 144,000	[8] 143,000	[8] 376,000	[9] 376,000
Paraguay [5]	10,000,000	13,000,000	13,000,000	13,000,000	13,000,000
Peru [5]	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Total	103,717,000	120,104,000	90,040,000	116,514,000	127,145,000

[1] Unofficial estimate.
[2] Small crop; no data.
[3] Data for 1908.
[4] Estimated from Census for 1900.
[5] Average production as unofficially estimated.
[6] Data for 1906.
[7] Estimated from official returns of acreage.
[8] Exports.
[9] Year preceding.
[10] Exports, 1905.

TOBACCO—Continued.

Tobacco crop of countries named, 1906–1910—Continued.

Country.	1906	1907	1908	1909	1910
EUROPE.					
Austria-Hungary:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria	17,884,000	15,129,000	14,630,000	19,188,000	13,590,000
Hungary	160,616,000	135,013,000	165,638,000	159,622,000	159,763,000
Bosnia-Herzegovina	10,077,000	6,396,000	[1] 6,396,000	11,464,000	[1] 11,464,000
Total Austria-Hungary	188,577,000	156,538,000	186,664,000	190,274,000	184,817,000
Belgium	15,001,000	19,476,000	18,597,000	19,474,000	[1] 19,474,000
Bulgaria	14,171,000	9,016,000	7,607,000	7,819,000	13,944,000
Denmark	340,000	160,000	[2] 160,000	[2] 160,000	[2] 160,000
France	36,416,000	40,810,000	50,056,000	42,273,000	36,446,000
Germany	70,713,000	61,665,000	75,858,000	62,120,000	63,611,000
Greece [3]	18,300,000	14,300,000	16,500,000	15,840,000	[1] 15,840,000
Italy	14,494,000	14,999,000	13,476,000	15,552,000	[1] 15,552,000
Netherlands	1,609,000	1,700,000	1,700,000	[2] 1,700,000	[2] 1,700,000
Roumania	9,994,000	15,554,000	16,099,000	12,098,000	15,434,000
Russia (including Asiatic)	162,020,000	226,258,000	207,948,000	194,948,000	200,773,000
Servia	2,381,000	2,422,000	1,732,000	4,633,000	4,314,000
Sweden	2,661,000	2,300,000	2,270,000	1,962,000	[1] 1,962,000
Turkey (European) [4]	[5] 49,177,000	49,177,000	[5] 49,177,000	[5] 49,177,000	[5] 49,177,000
Total	585,854,000	614,375,000	647,844,000	618,030,000	623,204,000
ASIA.					
British India [3]	450,000,000	450,000,000	450,000,000	450,000,000	450,000,000
British North Borneo [6]	3,264,000	2,953,000	3,155,000	2,678,000	[1] 2,678,000
Dutch East Indies:					
Java [7]	112,000,000	125,000,000	81,000,000	84,000,000	[1] 84,000,000
Sumatra, East Coast of	47,363,000	51,460,000	51,460,000	50,100,000	44,669,000
Total Dutch East Indies	159,363,000	176,460,000	132,460,000	134,100,000	128,669,000
Japanese Empire:					
Japan	96,997,000	100,390,000	91,374,000	91,850,000	[1] 91,850,000
Formosa	380,000	471,000	927,000	832,000	[1] 832,000
Total Japanese Empire	97,377,000	100,861,000	92,301,000	92,682,000	92,682,000
Philippine Islands	[8] 46,800,000	[8] 40,056,000	[8] 38,725,000	40,258,000	[1] 40,258,000
Total	756,804,000	770,330,000	716,641,000	719,718,000	714,287,000
AFRICA.					
Algeria	11,668,000	14,177,000	13,929,000	28,629,000	20,723,000
Mauritius	13,000	16,000	26,000	39,000	27,000
Nyasaland	1,037,000	585,000	570,000	1,234,000	1,643,000
Union of South Africa:					
Cape of Good Hope [3]	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Natal	3,103,000	2,771,000	3,105,000	2,527,000	[1] 2,527,000
Orange River Colony	[9] 650,000	[9] 650,000	[9] 650,000	646,000	[1] 646,000
Transvaal	[10] 3,226,000	5,077,000	2,754,000	2,891,000	5,346,000
Total Union of South Africa	11,979,000	13,498,000	11,509,000	11,064,000	13,519,000
Total	24,697,000	28,276,000	26,034,000	40,966,000	35,912,000
OCEANIA					
Australia:					
Queensland	1,146,000	723,000	274,000	604,000	450,000
New South Wales	821,000	602,000	385,000	430,000	728,000
Victoria	157,000	68,000	310,000	296,000	307,000
Total Australia	2,124,000	1,393,000	969,000	1,330,000	1,485,000
Fiji	1,000	44,000	38,000	18,000	24,000
Total	2,125,000	1,437,000	1,007,000	1,348,000	1,509,000
Grand total	2,270,298,000	2,366,769,000	2,356,055,000	2,701,048,000	2,756,077,000

[1] Year preceding.
[2] Data for 1907.
[3] Unofficial estimate.
[4] Not including vilayets of Scutari and Constantinople.
[5] Data for 1907.
[6] Exports.
[7] Exports; official returns for production are less than exports.
[8] Estimate from returns of the census.
[9] Data for 1905.
[10] Data for 1904.

TOBACCO—Continued.

Acreage, production, value, etc., of tobacco in the United States, 1849–1911.

Year.	Acreage, planted and harvested.	Average yield per acre.	Production.	Average farm price per pound Dec. 1.	Farm value Dec. 1.
	Acres.	*Pounds.*	*Pounds.*	*Cents.*	*Dollars.*
1849 [1]			*199,753,000*		
1859 [1]			*434,209,000*		
1869 [1]			*262,735,000*		
1879 [1]	*639,000*	*739.7*	*472,661,000*		
1889 [1]	*695,000*	*702.5*	*488,257,000*		
1899 [1]	*1,101,000*	*788.5*	*868,113,000*		
1900	1,046,000	778.0	814,345,000	6.6	53,661,000
1901	1,039,000	788.0	818,953,000	7.1	58,283,000
1902	1,031,000	797.3	821,824,000	7.0	57,564,000
1903	1,038,000	786.3	815,972,000	6.8	55,515,000
1904	806,000	819.0	660,461,000	8.1	53,383,000
1905	776,000	815.6	633,034,000	8.5	53,519,000
1906	796,000	857.2	682,429,000	10.0	68,233,000
1907	821,000	850.5	698,126,000	10.2	71,411,000
1908	875,000	820.2	718,061,000	10.3	74,130,000
1909	1,180,000	804.3	949,357,000	10.1	95,719,000
1909 [1]	*1,295,000*	*815.3*	*1,055,765,000*		
1910 [2]	1,366,000	807.7	1,103,415,000	9.3	102,142,000
1911 [2]	1,013,000	893.7	905,109,000	9.4	85,210,000

Year.	Domestic exports of unmanufactured, fiscal year beginning July 1.	Imports of unmanufactured, fiscal year beginning July 1.	Condition of growing crop.			
			July 1.	Aug. 1.	Sept. 1.	When harvested.
	Pounds.	*Pounds.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1900	315,787,782	26,851,253	88.5	82.9	77.5	76.1
1901	301,007,365	29,428,837	86.5	72.1	78.2	81.5
1902	368,184,084	34,016,956	85.6	81.2	81.5	84.1
1903	311,971,831	31,162,636	85.1	82.9	83.4	82.3
1904	334,302,091	33,288,378	85.3	83.9	83.7	85.6
1905	312,227,202	41,195,970	87.4	84.1	85.1	85.8
1906	340,742,864	40,898,807	86.7	87.2	86.2	84.6
1907	330,812,658	35,005,131	81.3	82.8	82.5	84.8
1908	287,900,946	43,123,196	86.6	85.8	84.3	84.1
1909	357,196,074	46,838,330	89.8	83.4	80.2	81.3
1910	355,327,072	45,927,230	85.3	78.5	77.7	80.2
1911			72.6	68.0	71.1	80.5

[1] Census figures. [2] Figures adjusted to census basis.

Acreage, production, and farm value of tobacco in the United States in 1911.

State and Division.	Acreage.	Production.	Farm value Dec. 1.	State and Division.	Acreage.	Production.	Farm value Dec. 1.
	Acres.	*Pounds.*	*Dollars.*		*Acres.*	*Pounds.*	*Dollars.*
New Hampshire	100	170,000	27,200	Illinois	1,000	750,000	58,500
Vermont	100	170,000	27,200	Wisconsin	41,000	51,250,000	5,125,000
Massachusetts	5,600	9,240,000	1,848,000	N. C. E. Miss. R.	152,000	153,420,000	12,931,460
Connecticut	17,000	27,625,000	5,663,125	Missouri	6,000	4,800,000	576,000
New York	3,800	5,054,000	525,616	N. C. W. Miss. R.	6,000	4,800,000	576,000
Pennsylvania	46,000	65,320,000	6,205,400	Kentucky	345,000	303,600,000	23,377,200
N. Atlantic	72,600	107,579,000	14,296,541	Tennessee	77,000	62,370,000	5,301,450
Maryland	26,000	19,110,000	1,433,250	Alabama	200	140,000	35,000
Virginia	160,000	128,000,000	12,288,000	Louisiana	500	225,000	69,750
West Virginia	15,000	11,250,000	900,000	Texas	300	195,000	39,000
North Carolina	140,000	99,400,000	11,530,400	Arkansas	800	480,000	57,600
South Carolina	13,600	11,016,000	1,388,016	S. Central	423,800	367,010,000	28,880,000
Georgia	1,200	1,080,000	302,400	United States	1,012,800	905,109,000	85,210,387
Florida	2,600	2,444,000	684,320				
S. Atlantic	358,400	272,300,000	28,526,386				
Ohio	88,000	81,400,000	6,186,400				
Indiana	22,000	20,020,000	1,561,560				

TOBACCO—Continued.

Average yield per acre and farm price per pound of tobacco in the United States.

State.	Yield per acre.						Farm price per pound.					
	10-year averages.				1910	1911	10-year averages for Dec. 1.				Dec. 1, 1910.	Dec. 1, 1911.
	1870–1879	1880–1889	1890–1899	1900–1909			1870–1879	1880–1889	1890–1899	1900–1909		
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
New Hampshire	1,294	1,517	1,650	1,665	1,720	1,700	16.9	12.2	15.5	14.9	15.0	16.0
Vermont	1,214	1,490	1,712	1,719	1,600	1,700	18.3	14.0	15.5	13.7	14.5	16.0
Massachusetts	1,505	1,495	1,658	1,666	1,730	1,650	17.1	13.5	16.3	14.8	15.0	20.0
Connecticut	1,446	1,441	1,477	1,657	1,730	1,625	18.9	13.6	16.8	16.4	16.5	20.5
New York	939	1,326	1,110	1,174	1,250	1,330	11.0	11.9	11.4	8.9	8.5	10.4
Pennsylvania	1,275	1,213	1,134	1,331	1,500	1,420	11.8	11.7	10.9	8.6	9.3	9.5
Maryland	675	635	655	634	690	735	7.2	6.5	6.3	6.5	7.7	7.5
Virginia	671	582	642	717	780	800	7.7	7.4	6.6	7.8	9.0	9.6
West Virginia	678	612	659	708	640	750	9.2	9.2	9.9	9.2	10.3	8.0
North Carolina	555	477	568	622	600	710	9.3	10.7	8.9	8.8	10.6	11.6
South Carolina	524	248	732	766	630	810	10.7	13.5	10.6	8.2	8.6	12.6
Georgia	546	248	452	668	680	900	17.3	14.0	12.8	24.4	20.0	28.0
Florida	678	184	495	722	680	940	20.8	19.0	29.0	31.4	23.0	28.0
Ohio	854	899	768	875	810	925	6.9	7.2	6.5	8.6	8.5	7.6
Indiana	715	699	679	819	880	910	5.7	6.6	6.6	7.8	9.5	7.8
Illinois	746	647	620	694	790	750	7.0	7.4	8.1	7.5	9.5	7.8
Wisconsin	946	957	1,078	1,278	1,050	1,250	8.6	10.7	7.4	8.6	7.5	10.0
Missouri	807	804	748	733	1,050	800	7.1	7.8	8.3	11.0	12.0	12.0
Kentucky	707	741	732	833	810	880	6.9	7.7	6.4	7.5	8.7	7.7
Tennessee	702	633	640	734	760	810	7.4	7.3	8.3	7.3	8.4	8.5
Alabama	581	220	418	419	500	700	17.9	16.5	15.5	21.8	20.0	25.0
Mississippi	552	288	600	470	......	......	18.8	15.0	15.0	21.0	......	......
Louisiana	......	......	461	450	550	450	......	......	25.3	26.2	25.0	31.0
Texas	744	306	445	581	600	650	21.6	16.0	20.2	22.0	25.0	20.0
Arkansas	764	568	603	578	650	600	12.9	8.8	11.0	13.0	16.0	12.0
United States	737.8	721.7	719.6	811.6	807.7	893.7	8.0	8.4	7.6	8.5	9.3	9.4

Wholesale prices of tobacco per pound, by months, on given markets, 1907–1911.

Dates.	Cincinnati.		Hopkinsville.		Louisville.		Clarksville.		Richmond.		Baltimore.	
	Leaf, plug stock.		Leaf.		Leaf (Burley, dark red).		Leaf.		Leaf, smokers.		Leaf (Maryland).	
	Common to good red.		Common to fine.		Common to good.		Common to fine.		Common to good.		Medium to fine red.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1907.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	6.75	13.00	6.50	14.00	6.50	11.00	7.00	11.00	9.00	13.00	7.00	12.00
February	6.75	13.00	6.50	14.00	7.00	12.00	7.50	11.00	9.00	13.00	7.00	12.00
March	6.50	12.75	7.50	14.00	7.50	12.00	7.50	14.00	9.00	13.00	7.00	12.00
April	6.50	12.75	7.50	15.00	7.50	13.50	8.00	14.00	9.00	13.00	7.00	12.00
May	6.50	12.75	7.75	15.00	7.50	13.00	8.00	14.00	9.00	13.00	6.50	12.00
June	6.50	12.75	7.50	15.00	8.50	13.50	9.25	15.00	9.00	13.00	7.00	12.00
July	6.50	17.50	8.00	16.00	8.00	13.50	10.00	17.00	9.00	13.00	7.00	12.00
August	8.50	17.50	8.00	16.00	8.50	14.00	10.00	14.00	9.00	13.00	7.00	12.00
September	8.50	17.50	8.00	16.00	8.50	14.00	9.50	14.00	9.00	13.00	7.00	12.00
October	8.50	17.50	7.50	14.00	8.00	14.50	9.50	12.00	9.00	13.00	7.00	12.00
November	8.50	17.50	Nominal.		9.00	14.50	9.50	12.00	9.00	13.00	7.00	12.00
December	8.50	17.50	Nominal.		9.00	14.50	9.50	14.50	9.00	13.00	7.00	12.00
Year	6.50	17.50	6.50	16.00	6.50	14.50	7.50	17.00	9.00	13.00	6.50	12.00
1908.												
January	8.00	17.00	Nominal.		9.00	13.00	10.00	14.50	9.00	13.00	7.00	12.00
February	8.00	15.00	11.00	20.00	9.00	14.00	10.00	15.00	9.00	13.00	7.00	12.00
March	8.00	15.00	9.00	14.50	10.00	14.00	11.00	18.00	9.25	13.25	7.00	12.00
April	8.00	16.00	9.50	16.00	10.50	14.00	11.50	18.00	9.25	13.25	7.00	12.00

TOBACCO—Continued.

Wholesale prices of tobacco per pound, by months, on given markets, 1907–1911—Contd.

Dates.	Cincinnati.		Hopkinsville.		Louisville.		Clarksville.		Richmond.		Baltimore.	
	Leaf, plug stock.		Leaf.		Leaf (Burley dark red).		Leaf.		Leaf, smokers.		Leaf (Maryland).	
	Common to good red.		Common to fine.		Common to good.		Common to fine.		Common to good.		Medium to fine red.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1908.	*Cents.*	*Cents*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
May	9.00	16.00	11.00	20.00	10.50	14.00	11.50	18.00	9.25	13.25	7.00	12.00
June	9.00	16.00	10.00	18.00	10.50	15.50	11.50	18.00	9.25	13.25	7.00	12.00
July	12.00	19.00	10.50	18.00	11.50	17.00	11.00	16.50	9.25	13.25	7.00	13.00
August	12.00	19.00	11.00	18.00	13.00	17.00	11.00	16.50	9.25	13.25	8.00	13.00
September	12.00	19.00	9.00	13.00	13.00	16.50	10.00	16.50	9.25	13.25	8.00	13.00
October	12.00	19.00	8.00	13.00	13.00	17.00	9.00	14.50	9.25	13.25	8.50	13.00
November	12.00	19.00	8.50	12.50	14.00	18.50	9.00	14.00	5.00	13.25	6.50	13.00
December	13.50	20.00	7.50	12.50	14.50	19.00	9.00	14.00	5.00	10.00	6.50	13.00
Year	8.00	20.00	7.50	20.00	9.00	19.00	9.00	18.00	5.00	13.25	6.50	13.00
1909.												
January	13.50	20.00	7.50	9.50	14.50	18.50	8.50	14.00	5.00	10.00	8.50	13.00
February	12.00	20.00	7.50	10.00	13.50	18.50	8.00	13.50	5.00	10.00	8.50	13.00
March	12.00	20.00	7.50	11.50	13.50	18.00	7.50	11.50	5.00	10.00	8.50	13.00
April	12.00	20.00	6.50	12.50	13.00	18.00	7.50	14.00	5.00	10.00	8.50	13.00
May	12.00	20.00	6.00	14.00	12.50	18.00	8.25	14.00	5.00	10.00	8.50	13.00
June	12.00	20.00	6.50	14.00	12.50	18.00	8.25	13.50	5.00	10.00	8.50	13.00
July	12.00	20.00	7.00	14.00	12.00	18.00	8.25	13.50	5.00	10.00	8.50	13.00
August	12.00	20.00	7.50	14.00	12.00	18.00	8.25	13.50	5.00	10.00	8.50	13.00
September	12.00	20.00	7.50	14.00	12.00	18.00	8.00	10.25	5.00	10.00	8.50	13.00
October	12.00	20.00	8.00	12.50	12.00	18.00	8.00	10.25	5.00	10.00	8.50	13.00
November	12.00	18.50	7.00	12.00	12.00	18.00	8.00	10.25	5.00	10.00	8.50	13.00
December	12.00	18.50	7.50	12.50	12.00	18.00	8.00	10.25	5.00	10.00	8.50	13.00
Year	12.00	20.00	6.00	14.00	12.00	18.50	7.50	14.00	5.00	10.00	8.50	13.00
1910.												
January	9.50	16.75	6.00	12.00	11.50	16.75	8.00	10.25	5.00	10.00	8.50	13.00
February	9.50	16.75	7.00	13.50	11.25	16.25	8.00	13.50	5.00	10.00	8.50	13.00
March	9.50	16.75	7.50	17.00	11.50	16.25	8.75	15.00	5.00	10.00	8.50	13.00
April	9.50	16.75	5.50	17.00	11.50	16.25	9.50	15.00	5.00	10.00	8.50	13.00
May	9.50	16.75	8.00	17.00	11.50	16.25	9.50	15.00	5.00	10.00	8.50	13.00
June	9.50	16.75	9.00	17.50	12.00	16.25	9.50	16.50	5.00	10.00	8.50	13.00
July	9.50	16.75	9.50	17.00	12.50	17.00	10.00	16.50	5.00	10.00	8.50	13.00
August	9.50	16.75	8.50	12.00	12.50	17.00	10.00	16.50	5.00	10.00	8.50	13.00
September	9.50	16.75	Nominal.		12.50	17.00	10.00	14.50	5.00	10.00	8.50	13.00
October	9.50	16.75	8.50	12.00	11.50	17.00	9.50	13.00	5.00	10.00	8.50	13.00
November	7.50	14.00	8.50	11.00	8.00	12.50	9.50	13.00	5.00	10.00	8.50	13.00
December	7.00	14.00	8.50	11.50	8.00	12.50	9.50	13.00	5.00	10.00	8.50	13.00
Year	7.00	16.75	6.00	17.50	8.00	17.00	8.00	16.50	5.00	10.00	8.50	13.00
1911.												
January	5.50	14.00	7.00	13.50	8.00	12.75	9.50	13.00	5.00	10.00	8.50	13.00
February	5.50	13.00	7.00	18.00	6.50	12.00	9.50	13.00	6.00	12.00	8.50	13.00
March	5.50	13.00	8.00	18.00	6.50	12.00	9.50	15.50	6.00	12.00	8.50	13.00
April	5.50	13.00	8.00	17.50	6.50	12.00	9.50	15.50	6.00	12.00	8.50	13.00
May	5.50	13.00	8.00	17.50	6.00	12.00	9.50	15.50	6.00	12.00	8.50	13.00
June	5.50	13.00	9.50	17.00	6.00	12.00	9.50	15.50	6.00	12.00	8.50	13.00
July	5.50	13.00	9.50	17.00	6.50	12.00	9.50	15.50	6.00	12.00	8.50	13.00
August	6.25	14.50	9.50	15.00	6.50	12.50	9.50	15.50	6.00	12.00	8.50	13.00
September	6.25	14.50	9.50	15.00	6.50	12.50	9.50	15.50	6.00	12.00	8.50	13.00
October	6.25	14.50	9.00	13.50	6.50	12.00	9.50	13.50	6.00	12.00	8.50	13.00
November	6.25	14.50	9.00	13.50	6.50	12.25	9.50	13.50	6.00	12.00	8.50	13.00
December	6.25	14.50	8.50	12.50	6.75	12.50	9.50	13.50	6.00	12.00	8.50	13.00
Year	5.50	14.50	7.00	18.00	6.00	12.75	9.50	15.50	5.00	12.00	8.50	13.00

TOBACCO—Continued.

International trade in unmanufactured tobacco, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Algeria	Jan. 1	10,047,124	7,754,758	4,073,480	[2] 8,655,360	[2] 13,726,720
Austria-Hungary	Jan. 1	19,093,790	21,637,704	21,044,440	21,456,931	24,903,382
Brazil	Jan. 1	52,094,709	65,459,601	32,129,345	64,654,476	[2] 75,284,885
British India	Jan. 1	28,092,899	28,787,031	19,006,506	17,195,391	24,515,681
Bulgaria	Jan. 1	3,493,435	2,678,406	5,532,100	4,347,506	5,233,789
Ceylon	Jan. 1	4,390,497	4,425,619	4,075,075	6,077,221	1,543,920
Cuba	Jan. 1	28,568,069	19,135,347	40,111,922	49,468,425	34,822,228
Dutch East Indies	Jan. 1	160,378,243	156,810,583	175,685,251	127,133,401	[2] 130,572,460
Greece	Jan. 1	17,736,290	14,965,568	10,786,962	13,159,838	12,659,828
Mexico	Jan. 1	4,023,645	4,479,953	3,884,456	2,837,311	1,231,928
Netherlands	Jan. 1	4,345,341	5,163,992	3,751,654	4,232,501	3,843,420
Philippine Islands	Jan. 1	26,685,768	23,589,657	24,927,663	20,976,743	21,926,744
Russia	Jan. 1	18,317,207	14,246,861	17,117,323	20,610,622	[2] 20,656,522
Santo Domingo	Jan. 1	15,179,810	22,947,168	18,665,594	24,822,623	22,262,108
Turkey	Mar. 14	[3] 39,267,984	[3] 39,267,984	65,600,000	77,800,000	[4] 77,800,000
United States	Jan. 1	336,730,455	317,399,986	305,455,871	351,564,177	328,562,036
Other countries		9,872,908	25,094,185	38,790,000	37,629,000	[2] 36,597,000
Total		778,318,174	773,844,403	790,637,642	852,621,526	836,142,651

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Argentina	Jan. 1	8,353,648	8,689,694	10,500,798	11,756,931	12,431,627
Australia	Jan. 1	7,538,329	10,169,916	12,886,746	9,370,516	13,586,845
Austria-Hungary	Jan. 1	52,855,812	36,349,587	43,908,354	48,820,867	53,311,196
Belgium	Jan. 1	21,146,214	20,158,453	20,927,037	21,194,579	20,994,432
British India	Jan. 1	5,284,295	4,993,124	6,618,473	7,514,446	6,583,970
Canada	Jan. 1	14,821,069	17,338,976	16,760,080	12,654,798	16,674,292
China	Jan. 1	16,034,533	17,770,000	11,234,933	8,273,200	13,519,067
Denmark	Jan. 1	10,399,202	11,208,298	19,896,714	3,306,900	9,272,768
Egypt	Jan. 1	18,250,013	18,801,016	19,147,819	18,753,130	18,103,095
Finland	Jan. 1	9,548,533	9,834,354	9,561,443	9,477,672	9,384,259
France	Jan. 1	54,816,081	62,557,408	63,594,945	44,485,742	61,265,614
Germany [5]	Jan. 1	131,495,120	156,698,138	170,494,442	172,018,104	146,926,890
Italy	Jan. 1	45,918,749	43,913,866	44,893,159	49,666,772	41,454,417
Netherlands	Jan. 1	46,588,181	50,172,040	47,965,176	52,343,677	55,045,754
Norway	Jan. 1	3,487,734	3,877,092	3,648,473	3,700,179	4,141,628
Portugal	Jan. 1	4,355,601	5,713,143	5,160,110	6,990,132	5,701,360
Spain	Jan. 1	30,043,202	51,055,584	31,921,214	40,997,520	44,337,800
Sweden	Jan. 1	8,361,847	9,212,130	9,165,985	9,135,007	9,438,252
Switzerland	Jan. 1	15,747,394	17,561,357	16,721,617	16,542,877	17,135,474
United Kingdom	Jan. 1	83,766,884	87,329,290	87,933,057	85,654,211	88,141,019
United States	Jan. 1	41,726,224	34,088,288	37,665,211	44,221,940	42,343,323
Other countries		55,711,151	50,720,308	61,800,000	63,139,000	[2] 59,646,000
Total		686,249,816	728,212,062	752,405,786	740,018,200	749,439,082

[1] See "General note," p. 526.
[2] Preliminary.
[3] Data for 1900.
[4] Year preceding.
[5] Not including free ports prior to Mar. 1, 1906.

FLAXSEED.

Flax area of countries named, 1908–1910.

Country.	1908	1909	1910
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*
United States	2,679,000	2,083,100	2,467,000
Canada:			
Manitoba	23,400	22,400	24,600
Saskatchewan	110,000	110,300	438,000
Alberta	5,900	5,800	14,300
Total	139,300	138,500	476,900
Mexico	(1)	(1)	(1)
SOUTH AMERICA.			
Argentina	3,438,300	3,791,300	3,596,800
Uruguay	63,500	45,300	(1)
Total	3,501,800	3,836,600	....
EUROPE.			
Austria-Hungary:			
Austria	123,700	111,100	95,900
Hungary proper	27,100	23,400	21,100
Croatia-Slavonia	17,500	(1)	....
Bosnia-Herzegovina	(1)	(1)	....
Belgium	51,200	39,300	(1)
Bulgaria	300	400	900
France	70,600	50,500	53,600
Italy	(1)	(1)	4,400
Netherlands	35,600	24,800	29,000
Roumania	44,900	30,100	33,100
Russia:			
Russia proper	3,250,900	3,120,200	....
Poland	87,500	90,600	....
Northern Caucasia	63,500	63,300	....
Total Russia (European)	3,401,900	3,274,100	....
Servia	(1)	(1)	(1)
Sweden	4,500	4,200	(1)
United Kingdom (Ireland)	46,900	38,100	46,000
ASIA.			
British India, including such native States as report	2,099,400	2,997,000	3,194,600
Russia:			
Central Asia	[2] 75,300	176,600	....
Siberia	111,700	128,800	....
Transcaucasia	(1)	22,900	....
Total Russia (Asiatic)	....	....	....
AFRICA.			
Algeria	1,000	....	....

[1] No official data. [2] Four Provinces only.

FLAXSEED—Continued.

Flax crop of countries named, 1908–1910.

Country.	Seed.			Fiber.		
	1908	1909	1910	1908	1909	1910
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*
United States	25,805,000	19,513,000	12,718,000			
Canada:						
Manitoba	281,000	317,000	290,000			
Saskatchewan	1,144,000	1,787,000	3,448,000			
Alberta	74,000	109,000	64,000			
Total	1,499,000	2,213,000	3,802,000			
Mexico	150,000	150,000	150,000			
Total North America	27,454,000	21,876,000	16,670,000			
SOUTH AMERICA.						
Argentina	43,333,000	41,291,000	28,212,000			
Uruguay	723,000	522,000	600,000			
Total	44,056,000	41,813,000	28,612,000			
EUROPE.						
Austria-Hungary:						
Austria	932,000	852,000	663,000	74,106,000	68,136,000	50,191,000
Hungary proper	190,000	200,000	164,000	19,965,000	20,000,000	18,492,000
Croatia-Slavonia	30,000	30,000	30,000	8,861,000	9,000,000	8,000,000
Bosnia-Herzegovina	4,000	4,000	4,000	1,400,000	1,400,000	1,000,000
Total Austria-Hungary	1,156,000	1,086,000	861,000	104,332,000	98,536,000	77,683,000
Belgium	300,000	300,000	300,000	27,000,000	27,000,000	28,000,000
Bulgaria	2,000	2,000	8,000	168,000	200,000	709,000
France	722,000	436,000	416,000	47,886,000	30,494,000	33,106,000
Italy	(1)	281,000	232,000	7,000,000	7,242,000	6,883,000
Netherlands	341,000	219,000	316,000	19,692,000	13,438,000	14,189,000
Roumania	180,000	205,000	363,000	2,404,000	1,628,000	4,448,000
Russia:						
Russia proper	17,326,000	19,767,000		1,500,000,000	1,022,484,000	
Poland	903,000	948,000		70,000,000	42,450,000	
Northern Caucasia	410,000	583,000		26,000,000	26,130,000	
Total Russia (European)	18,639,000	21,298,000		1,596,000,000	1,091,064,000	
Servia				1,032,000	1,100,000	1,100,000
Sweden	22,000	21,000	21,000	1,547,000	1,449,000	1,400,000
United Kingdom (Ireland)				17,745,000	16,081,000	19,882,000
Total	21,362,000	23,848,000		1,824,806,000	1,288,232,000	
ASIA.						
British India, including such native States as report	6,528,000	11,552,000	17,104,000			
Russia:						
Central Asia	[2] 495,000	966,000		27,000,000	51,864,000	
Siberia	797,000	771,000		45,785,000	38,109,000	
Transcaucasia	150,000	107,000		10,000,000	6,429,000	
Total Russia (Asiatic)	1,442,000	1,844,000		82,785,000	96,402,000	
Total Asia	7,970,000	13,396,000		82,785,000	96,402,000	
AFRICA.						
Algeria	8,000	10,000	10,000			
Grand total	100,850,000	100,943,000		1,907,591,000	1,384,634,000	

[1] No official data.

[2] Incomplete official returns.

FLAXSEED—Continued.

Acreage, production, value, etc., of flaxseed in the United States, 1849–1911.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.	Condition of growing crop.			
						July 1.	Aug. 1.	Sept. 1.	When harvested.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1849 [1]			562,000						
1859 [1]			567,000						
1869 [1]			1,730,000						
1879 [1]			7,170,000						
1889 [1]	1,319,000	7.8	10,250,000						
1899 [1]	2,111,000	9.5	19,979,000						
1902	3,740,000	7.8	29,285,000	105.0	30,815,000				
1903	3,233,000	8.4	27,301,000	81.7	22,292,000	86.2	80.3	80.5	74.0
1904	2,264,000	10.3	23,401,000	99.3	23,229,000	86.6	78.9	85.8	87.0
1905	2,535,000	11.2	28,478,000	84.4	24,049,000	92.7	96.7	94.2	91.5
1906	2,506,000	10.2	25,576,000	101.3	25,899,000	93.2	92.2	89.0	87.4
1907	2,864,000	9.0	25,851,000	95.6	24,713,000	91.2	91.9	85.4	78.0
1908	2,679,000	9.6	25,805,000	118.4	30,577,000	92.5	86.1	82.5	81.2
1909	2,742,000	9.4	25,856,000	152.6	39,466,000	95.1	92.7	88.9	84.9
1909 [1]	2,083,000	9.4	19,513,000						
1910 [2]	2,467,000	5.2	12,718,000	231.7	29,472,000	65.0	51.7	48.3	47.2
1911 [2]	2,757,000	7.0	19,370,000	182.1	35,272,000	80.9	71.0	68.4	69.6

[1] Census. [2] Figures adjusted to census basis.

Acreage, production, and value of flaxseed in the United States in 1911, by States.

State.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Dollars.*	*Dollars.*
Wisconsin	10,000	12.0	120,000	1.85	222,000
Minnesota	400,000	8.0	3,200,000	1.82	5,824,000
Iowa	16,000	8.0	128,000	1.85	237,000
Missouri	18,000	3.0	54,000	1.90	103,000
North Dakota	1,200,000	7.6	9,120,000	1.84	16,781,000
South Dakota	607,000	5.3	3,217,000	1.78	5,726,000
Nebraska	2,000	5.0	10,000	1.85	18,000
Kansas	75,000	3.0	225,000	1.90	428,000
Oklahoma	1,000	3.0	3,000	1.80	5,000
Montana	425,000	7.7	3,272,000	1.80	5,890,000
Colorado	3,000	7.0	21,000	1.80	38,000
United States	2,757,000	7.0	19,370,000	1.821	35,272,000

Average farm price of flaxseed per bushel, on the first of each month, 1910–1911.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910	1911	1910
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	221.1	171.2					215.0	148.0	221.0	171.4				
February	233.9	192.9					240.0	177.0	234.0	193.2	220.0			
March	240.7	193.1					250.0	187.0	240.0	193.1				
April	234.6	193.9					285.0	182.0	234.0	194.0	225.0			225.0
May	241.9	209.5					240.0	180.0	242.0	209.8	300.0			242.0
June	225.0	195.5					250.0	175.0	225.0	195.6		175.0		250.0
July	205.6	183.5					219.0	148.0	205.0	183.9				
August	199.2	209.7					193.0	175.0	198.0	210.3		180.0	210.0	208.0
September	203.6	220.0					202.0	174.0	203.0	221.4		150.0	210.0	165.0
October	205.0	233.4					223.0	216.0	205.0	234.8		150.0	202.0	240.0
November	210.6	229.4					210.0	217.0	211.0	230.1		70.0		243.0
December	182.1	230.6					185.0	220.0	182.0	230.9	180.0	112.0	180.0	240.0

FLAXSEED—Continued.

Wholesale prices of flaxseed per bushel, 1898–1911.

Date.	St. Louis.		Cincinnati.		Chicago.		Milwaukee.		Duluth.	
	Prime.		Low.	High.	No. 1 and No. 1 Northwestern.		No. 1 Northwestern.		Low.	High.
	Low.	High.			Low.	High.	Low.	High.		
1898	$0.84	$1.36½	$0.80	$0.90	$0.85	$1.39	$0.88	$1.39	$0.86½	$1.35
1899	.93	1.46	.90	1.00	.96½	1.51	.99	1.52	.90	1.42
1900	1.25	1.78	1.00	1.45	1.32	1.86	1.30	1.86	1.28½	1.87
1901	1.37	1.72	1.20	1.50	1.38	1.90	1.30	1.88	1.33	1.88
1902	1.11	1.65	1.25	1.40	1.13	1.80	1.18	1.80	1.15¼	1.78
1903	.86	1.17	1.00	1.30	.89	1.24	.94	1.24	.92	1.20
1904	.92½	1.18½	1.00	1.00	.97	1.28	1.06	1.28	1.01½	1.28
1905	.90	1.30	1.10	1.10	.92	1.47	.98	1.47	.96¼	1.50
1906	.98	1.19	1.10	1.12	1.03	1.25	1.05	1.25	1.09¼	1.25
1907	1.00	1.27	1.12	....	.96	1.36½	1.07	1.34	1.06½	1.41½
1908.										
January	1.11	1.18	1.12	....	1.09	1.22¼	1.15¾	1.20	1.14⅛	1.19
February	1.14	1.18½	1.12	....	1.06½	1.21½	1.16	1.19½	1.12¾	1.18
March	1.13	1.16	1.12	....	1.07¾	1.20½	1.17	1.20	1.14½	1.17
April	1.13½	1.17½	1.12	....	1.07	1.22	1.12	1.19½	1.14⅜	1.20
May	1.16	1.20	1.12	....	1.11½	1.25½	1.19	1.26	1.19⅞	1.24½
June	1.18	1.19½	1.12	....	1.14¾	1.25¾	1.21	1.26	1.20½	1.24½
July	1.00	1.12	1.12	1.15	1.14¾	1.27¼	1.21	1.23½	1.20⅛	1.25¾
August	1.00	1.20	1.15	1.25	1.17½	1.35½	1.23½	1.33	1.25¼	1.34¼
September	1.11	1.18	1.25	....	1.12¾	1.28⅝	1.23	1.28	1.21½	1.28⅝
October	1.12	1.19	1.25	....	1.12½	1.29¼	1.23	1.29	1.21½	1.28¼
November	1.19	1.35	1.25	....	1.18½	1.47	1.29	1.44¾	1.28⅛	1.46⅞
December	1.34	1.39½	1.25	....	1.33½	1.51½	1.42¼	1.47	1.41	1.49⅜
Year	1.00	1.39½	1.12	1.25	1.06½	1.51½	1.12	1.47	1.12¾	1.49⅜
1909.										
January	1.42½	1.51	1.25	....	1.44	1.61½	1.53¼	1.62¼	1.52	1.59½
February	1.50	1.63	1.25	....	1.50½	1.73½	1.60	1.71	1.58⅝	1.70⅜
March	1.55	1.63	1.25	....	1.52	1.71½	1.60¾	1.70	1.61	1.68⅝
April	1.53	1.60	1.75	....	1.53¼	1.69½	1.66	1.70	1.63¼	1.68¾
May	1.53½	1.66½	1.75	....	1.55	1.82	1.66½	1.80¾	1.64¾	1.82
June	1.50	1.65	1.75	....	1.54½	1.71½	1.64	1.78¼	1.75	1.81¾
July	1.20	1.50	1.75	....	1.29	1.65	1.40	1.66	1.39¾	1.79
August	1.15	1.35	1.75	....	1.35	1.45	1.35	1.45	1.38	1.50
September	1.32	1.38	1.75	....	1.32½	1.51	1.40	1.50	1.37½	1.47
October	1.35	1.60	1.75	....	1.32	1.73	1.42½	1.74¼	1.36½	1:74¼
November	1.55	1.72	1.75	....	1.56	1.84½	1.68	1.84	1.66½	1.84¾
December	1.68	1.90	1.75	....	1.70	1.99	1.80	2.09	1.76¾	2.04½
Year	1.15	1.90	1.25	....	1.29	1.99	1.35	2.09	1.36½	2.04½
1910.										
January	1.90	2.10	1.75	2.00	1.92	2.26	2.09	2.20	2.02	2.27
February	2.05	2.09	2.00	....	2.04	2.22	2.13	2.21	2.15¼	2.20¼
March	2.08	2.24	2.00	....	2.09½	2.35	2.18	2.35	2.17	2.35
April	2.18	2.30	2.00	....	2.20	2.43½	2.32	2.45	2.32	2.46
May	....	....	2.00	2.75	1.94½	2.42½	1.96	2.40	2.08	2.38¼
June	....	....	2.25	2.75	1.75	2.18	1.91½	2.20	1.89	2.20
July	1.80	2.18	2.25	2.75	1.97½	2.55	2.10	2.50	2.10	2.67
August	2.18	2.35	2.25	2.75	2.23	2.57½	2.40	2.55	2.42½	2.60
September	2.35	2.68	2.40	....	2.21	2.84	2.36	2.75	2.34	2.84
October	2.30	2.54	2.40	2.50	2.29	2.70	2.39	2.68	2.41¾	2.69
November	2.39	2.59	2.50	....	2.37	2.73	2.52	2.70	2.50	2.74
December	2.25	2.43	2.50	....	2.22½	2.57	2.32½	2.55	2.31½	2.54½
Year	1.80	2.68	1.75	2.75	1.75	2.84	1.91½	2.75	1.89	2.84
1911.									No. 1.	
January	2.35	2.58	2.50	2.50	2.37	2.70½	2.46	2.69	2.47	2.68½
February	2.56	2.60½	2.50	2.50	2.54	2.74½	2.64	2.70	2.63⅞	2.70
March	2.45	2.60	2.50	2.50	2.35½	2.69	2.44	2.67	2.46	2.67
April	2.46	2.57	2.50	2.50	2.39½	2.63½	2.48	2.62	2.48	2.62
May	2.28	2.60	2.50	2.75	2.25½	2.55	2.21	2.60	2.21	2.61
June	1.80	2.35	2.75	2.75	....	....	2.05	2.35	2.06	2.34
July	1.80	1.85	2.75	2.75	....	....	2.04	2.18	2.05	2.19
August	1.82	2.00	2.75	2.75	2.35	2.57	2.08	2.52	2.10	2.52
September	2.25	2.40	....	....	2.27	2.69½	2.28	2.62	2.27½	2.65
October	2.15	2.43	....	....	2.13	2.47	2.11½	2.46	2.12	2.47
November	1.98	2.17	....	....	1.93	2.17	1.92	2.18	1.93	2.17½
December	2.00	2.14	....	....	1.94	2.16	2.03	2.13	1.94	2.18
Year	1.80	2.60½	2.50	2.75	1.93	2.74½	1.92	2.70	1.93	2.70

RICE.

Rice crop of countries named, 1906–1910.

[Mostly cleaned rice. The United States crop as given here is computed from the official returns, which are for rough rice, allowing 45 pounds rough to 1 bushel, and 162 pounds rough to 100 pounds cleaned. China, which is omitted, has a roughly estimated crop of 50,000,000,000 to 60,000,000,000 pounds. Other omitted countries are Afghanistan, Algeria, Colombia, Federated Malay States, Persia, Trinidad and Tobago, Venezuela, and a few other countries of small production.]

Countries.	1906	1907	1908	1909	1910
NORTH AMERICA.					
United States:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Contiguous	496,000,000	520,000,000	608,056,000	676,889,000	680,833,000
Noncontiguous—					
Hawaii [1]	33,400,000	33,400,000	33,400,000	33,400,000	33,400,000
Total United States (except Philippine Islands)	529,400,000	553,400,000	641,456,000	710,289,000	714,233,000
Central America:					
Guatemala [2]	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000
Honduras [3]	8,100,000	8,100,000	8,100,000	8,100,000	8,100,000
Mexico	69,932,000	[4] 69,932,000	[4] 69,932,000	[4] 69,932,000	124,900,000
Total	608,732,000	632,732,000	720,788,000	789,621,000	848,533,000
SOUTH AMERICA.					
Argentina	[5] 2,000,000	17,808,000	[6] 19,000,000	[7] 19,000,000	[7] 19,000,000
Brazil: Sao Paulo [8]	83,000,000	83,000,000	83,000,000	83,000,000	83,000,000
British Guiana	56,000,000	[6] 59,000,000	71,300,000	91,000,000	[9] 91,000,000
Dutch Guiana	3,298,000	3,331,000	3,718,000	4,326,000	[9] 4,326,000
Peru	[5] 209,500,000	[5] 209,500,000	194,000,000	225,000,000	[9] 225,000,000
Total	353,798,000	372,639,000	371,018,000	422,326,000	422,326,000
EUROPE.					
Austria	200,000	....	....	....	....
Bulgaria	8,205,000	7,758,000	6,336,000	11,426,000	10,240,000
Greece	[10] 2,900,000	[10] 2,900,000	[10] 2,900,000	[11] 2,900,000	[9] 2,900,000
Italy	704,000,000	796,000,000	716,000,000	647,000,000	596,031,000
Spain	425,800,000	475,400,000	449,700,000	456,900,000	465,431,000
Turkey, European	[10] 2,200,000	[10] 2,200,000	[10] 2,200,000	2,200,000	[9] 2,200,000
Total	1,143,305,000	1,284,258,000	1,177,136,000	1,120,426,000	1,076,802,000
ASIA.					
British India: [12]					
British Provinces	67,464,000,000	60,729,000,000	61,306,000,000	87,359,000,000	[13] 86,872,000,000
Native States	[6] 688,000,000	[6] 739,000,000	[6] 1,602,000,000	[7] 1,602,000,000	[7] 1,602,000,000
Total British India	68,152,000,000	61,468,000,000	62,908,000,000	88,961,000,000	88,474,000,000
Ceylon	283,000,000	333,000,000	309,000,000	320,000,000	320,000,000
Formosa	2,478,603,000	2,818,100,000	2,908,000,000	2,892,000,000	[9] 2,892,000,000
French Indo-China [5]	5,000,000,000	5,000,000,000	5,000,000,000	5,000,000,000	5,000,000,000
Japan	14,459,285,000	15,317,905,000	16,217,500,000	16,375,000,000	14,562,000,000
Java and Madura	6,953,000,000	6,877,000,000	7,276,000,000	7,566,000,000	[9] 7,566,000,000

[1] Census, 1899.
[2] Data for 1904.
[3] Data for 1901.
[4] Data for 1906.
[5] Average production as unofficially estimated.
[6] Estimated from official returns for acreage.
[7] Data for 1908.
[8] Official report for crop of 1904–5.
[9] Year preceding.
[10] Data for 1909.
[11] Unofficial estimate.
[12] Data for British India refer to crop years beginning in the spring of the calendar years mentioned in this table. Production as given here, estimated unofficially for the entire country on the basis of official *returns for* about 70 per cent of the area harvested.
[13] Preliminary.

RICE—Continued.

Rice crop of countries named, 1906–1910—Continued.

Country.	1906	1907	1908	1909	1910
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Korea [1]	3,200,000,000	3,200,000,000	3,200,000,000	3,200,000,000	3,200,000,000
Philippine Islands	725,000,000	695,000,000	568,000,000	[2] 1,048,000,000	[3] 1,048,000,000
Russia, Asiatic: Caucasus and Central Asia	[4] 393,000,000	393,000,000	[3] 393,000,000	372,000,000	363,000,000
Siam [5]	6,824,000,000	6,824,000,000	6,824,000,000	6,824,000,000	6,824,000,000
Straits Settlements [6]	94,000,000	79,000,000	77,000,000	77,000,000	77,000,000
Turkey, Asiatic	[7] 222,480,000	[7] 222,480,000	[7] 222,480,000	222,480,000	[3] 222,480,000
Total	108,784,368,000	103,227,485,000	105,902,980,000	132,857,480,000	130,548,480,000
AFRICA.					
Egypt [6]	515,573,000	557,124,000	577,379,000	630,894,000	663,556,000
Madagascar	[8] 953,000,000	[8] 953,000,000	953,000,000	[8] 953,000,000	[8] 953,000,000
Nyassaland [9]	1,400,000	1,978,000	1,600,000	1,900,000	1,900,000
Total	1,469,973,000	1,512,102,000	1,531,979,000	1,585,794,000	1,618,456,000
OCEANIA.					
Fiji [6]	3,000,000	2,000,000	3,000,000	5,000,000	5,000,000
Grand total	112,363,176,000	107,031,216,000	109,706,901,000	136,780,647,000	134,519,597,000

[1] Estimated from official returns of exports of this country and from per capita consumption of rice in Japan, 1894–1903, including food, seed, and waste, but not including rice used for saké (270 pounds per annum).
[2] Data for crop year beginning July 1 of calendar year mentioned.
[3] Data for preceding year.
[4] Data for 1907.
[5] Data for 1903.
[6] Estimated from official returns for acreage.
[7] Data for 1909.
[8] Data for 1908.
[9] Includes only crops raised by natives.

Acreage, production, value, etc., of rice in the United States, 1904–1911.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.	Condition of growing crop.			
						July 1.	Aug. 1.	Sept. 1.	When harvested.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1904	662,000	31.9	21,096,000	65.8	13,892,000	88.2	90.2	89.7	87.3
1905	460,000	28.1	12,933,000	95.0	12,286,000	88.0	92.9	92.2	89.3
1906	575,000	31.1	17,855,000	90.3	16,121,000	82.9	83.1	86.8	87.2
1907	627,000	29.9	18,738,000	85.8	16,081,000	88.7	88.6	87.0	88.7
1908	655,000	33.4	21,890,000	81.2	17,771,000	92.9	94.1	93.5	87.7
1909	720,000	33.8	24,368,000	79.4	19,341,000	90.7	84.5	84.7	81.2
1910	723,000	33.9	24,510,000	67.8	16,624,000	86.3	87.6	88.8	88.1
1911	696,000	32.9	22,934,000	79.7	18,274,000	87.7	88.3	87.2	85.4

Acreage, production, and farm value of rice in the United States in 1911, by States.

State.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
North Carolina	500	25.6	13,000	76	10,000
South Carolina	10,000	11.7	117,000	75	88,000
Georgia	1,450	26.8	39,000	77	30,000
Florida	700	25.0	18,000	75	14,000
Alabama	300	20.0	6,000	70	4,000
Mississippi	2,100	36.0	76,000	77	59,000
Louisiana	371,200	31.5	11,693,000	79	9,237,000
Texas	238,300	34.3	8,174,000	80	6,539,000
Arkansas	71,600	39.0	2,792,000	82	2,289,000
California	150	40.0	6,000	75	4,000
United States	696,300	32.9	22,934,000	79.7	18,274,000

RICE—Continued.

Wholesale prices of rice per pound, 1898–1911.

Date.	New York.		Cincinnati.		Lake Charles.		New Orleans.		Houston.	
	Domestic (good).		Prime.[1]		Rough.[2]		Honduras, cleaned.		Head rice, cleaned.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Dolls.*	*Dolls.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1898	$4\frac{7}{8}$	$5\frac{5}{8}$	$5\frac{1}{2}$	7	......	......	$4\frac{1}{4}$	$5\frac{1}{2}$	......	......
1899	$4\frac{3}{4}$	$5\frac{1}{2}$	$5\frac{1}{4}$	$6\frac{3}{4}$	......	......	$3\frac{3}{4}$	$6\frac{3}{8}$	......	......
1900	$4\frac{3}{4}$	5	$5\frac{1}{2}$	6	......	......	$3\frac{3}{4}$	$6\frac{5}{8}$	......	......
1901	$4\frac{3}{4}$	5	$5\frac{1}{2}$	$6\frac{1}{2}$	1.70	3.50	$1\frac{3}{4}$	$6\frac{5}{8}$	3	5
1902	$4\frac{3}{4}$	$5\frac{1}{4}$	$5\frac{1}{4}$	$6\frac{1}{2}$	1.75	3.40	$1\frac{1}{2}$	$6\frac{1}{2}$	$3\frac{1}{2}$	$5\frac{3}{4}$
1903	$4\frac{1}{4}$	$5\frac{1}{4}$	$4\frac{3}{8}$	$5\frac{1}{2}$	1.50	3.60	$1\frac{1}{8}$	$6\frac{1}{2}$	4	$6\frac{1}{4}$
1904	$3\frac{3}{8}$	$4\frac{1}{4}$	$3\frac{3}{4}$	$5\frac{1}{4}$	1.00	3.00	$1\frac{1}{16}$	$5\frac{1}{4}$	3	$4\frac{3}{4}$
1905	$3\frac{3}{8}$	$4\frac{1}{2}$	3	$5\frac{1}{4}$	1.00	3.85	1	$5\frac{3}{4}$	3	5
1906	$4\frac{7}{8}$	$5\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	2.00	3.85	$1\frac{1}{8}$	6	$3\frac{1}{2}$	$5\frac{3}{4}$
1907	5	6	$4\frac{3}{4}$	6	1.75	4.10	$1\frac{1}{2}$	$6\frac{1}{2}$	$4\frac{7}{8}$	$6\frac{1}{4}$
1908.										
January	5	$5\frac{1}{4}$	$6\frac{3}{4}$	$7\frac{1}{2}$	2.25	3.75	2	6	$4\frac{3}{4}$	$5\frac{1}{4}$
February	$5\frac{1}{4}$	$5\frac{5}{8}$	$6\frac{3}{4}$	$7\frac{1}{4}$	2.00	4.25	2	$6\frac{3}{16}$	5	$5\frac{1}{2}$
March	$5\frac{5}{8}$	$5\frac{3}{4}$	$6\frac{3}{4}$	$7\frac{1}{4}$	2.25	4.33	$2\frac{1}{8}$	$6\frac{1}{4}$	5	$5\frac{1}{2}$
April	$5\frac{3}{4}$	$5\frac{3}{4}$	$6\frac{3}{4}$	$7\frac{1}{4}$	......	......	$2\frac{1}{2}$	$6\frac{1}{4}$	$5\frac{1}{8}$	$5\frac{3}{4}$
May	$5\frac{3}{4}$	$5\frac{7}{8}$	$6\frac{3}{4}$	$7\frac{1}{4}$	......	......	$2\frac{5}{8}$	$6\frac{1}{8}$	$5\frac{1}{8}$	6
June	$5\frac{7}{8}$	$6\frac{1}{4}$	$6\frac{3}{4}$	$7\frac{1}{4}$	......	......	$2\frac{1}{8}$	$6\frac{1}{4}$	$5\frac{1}{4}$	$6\frac{1}{8}$
July	$6\frac{1}{4}$	$6\frac{1}{4}$	$6\frac{3}{4}$	$7\frac{1}{4}$	......	......	3	$7\frac{1}{8}$	$5\frac{1}{2}$	$6\frac{1}{4}$
August	$6\frac{1}{4}$	$6\frac{1}{2}$	$6\frac{3}{4}$	$7\frac{1}{4}$	2.50	3.50	$2\frac{1}{2}$	7	$5\frac{1}{2}$	6
September	$5\frac{7}{8}$	6	$6\frac{1}{4}$	$7\frac{1}{4}$	2.00	3.60	$1\frac{7}{8}$	6	$5\frac{1}{4}$	$5\frac{3}{4}$
October	$5\frac{1}{4}$	$5\frac{1}{2}$	$6\frac{1}{4}$	$6\frac{3}{4}$	1.75	3.75	$1\frac{3}{4}$	6	5	$5\frac{3}{8}$
November	5	$5\frac{1}{8}$	$6\frac{1}{4}$	$6\frac{3}{4}$	2.25	3.60	$1\frac{7}{8}$	$5\frac{3}{4}$	$4\frac{3}{4}$	$5\frac{1}{4}$
December	5	$5\frac{1}{4}$	$6\frac{1}{4}$	$6\frac{3}{4}$	1.75	3.40	$1\frac{3}{4}$	$5\frac{3}{4}$	$4\frac{3}{4}$	$5\frac{1}{4}$
Year	5	$6\frac{1}{2}$	$6\frac{1}{4}$	$7\frac{1}{2}$	1.75	4.33	$1\frac{3}{4}$	$7\frac{1}{8}$	$4\frac{3}{4}$	$6\frac{1}{4}$
1909.										
January	5	$5\frac{1}{2}$	[3] $6\frac{1}{4}$	7	1.75	3.75	$1\frac{1}{8}$	6	$4\frac{3}{4}$	$5\frac{1}{8}$
February	$5\frac{1}{2}$	$5\frac{3}{4}$	$6\frac{1}{4}$	7	2.00	3.63	$1\frac{7}{8}$	$6\frac{3}{16}$	$4\frac{7}{8}$	$5\frac{1}{4}$
March	$5\frac{3}{4}$	$5\frac{3}{4}$	$6\frac{1}{4}$	7	2.25	3.63	2	$6\frac{1}{8}$	$4\frac{7}{8}$	$5\frac{3}{8}$
April	$5\frac{3}{4}$	$5\frac{3}{4}$	$6\frac{1}{4}$	7	2.25	3.60	2	$6\frac{1}{8}$	5	$5\frac{1}{2}$
May	$5\frac{3}{4}$	$5\frac{7}{8}$	$6\frac{1}{4}$	7	2.00	3.40	2	$6\frac{5}{16}$	$5\frac{1}{8}$	$5\frac{1}{2}$
June	$5\frac{3}{4}$	$5\frac{7}{8}$	$6\frac{1}{4}$	7	1.75	3.00	$1\frac{7}{8}$	$6\frac{1}{8}$	$5\frac{1}{4}$	$5\frac{3}{4}$
July	$5\frac{1}{2}$	$5\frac{3}{4}$	$6\frac{1}{4}$	7	......	......	$1\frac{7}{8}$	$6\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{8}$
August	[4] $5\frac{3}{4}$	[4] 6	$6\frac{1}{4}$	7	......	......	$1\frac{3}{4}$	$6\frac{3}{8}$	$5\frac{1}{2}$	$5\frac{3}{4}$
September	$5\frac{1}{8}$	$5\frac{1}{4}$	$6\frac{1}{4}$	7	1.50	3.25	$1\frac{1}{4}$	$5\frac{7}{8}$	$5\frac{1}{4}$	$5\frac{5}{8}$
October	5	$5\frac{1}{8}$	6	7	2.00	3.50	$1\frac{1}{2}$	6	5	$5\frac{3}{8}$
November	$4\frac{7}{8}$	5	6	$6\frac{1}{2}$	1.75	3.25	$1\frac{3}{4}$	$5\frac{5}{8}$	$4\frac{5}{8}$	$5\frac{1}{4}$
December	$4\frac{3}{4}$	$4\frac{7}{8}$	6	$6\frac{1}{2}$	1.50	3.30	$1\frac{5}{8}$	$5\frac{3}{4}$	$4\frac{5}{8}$	$5\frac{1}{8}$
Year	$4\frac{3}{4}$	$5\frac{7}{8}$	6	7	1.50	3.75	$1\frac{1}{8}$	$6\frac{1}{2}$	$4\frac{5}{8}$	$6\frac{1}{8}$
1910.										
January	$4\frac{7}{8}$	$5\frac{1}{8}$	6	$6\frac{1}{2}$	1.75	3.25	$1\frac{3}{8}$	$6\frac{1}{8}$	$3\frac{1}{4}$	5
February	$4\frac{3}{4}$	$4\frac{7}{8}$	6	$6\frac{1}{2}$	1.75	3.25	$1\frac{1}{2}$	6	$3\frac{5}{8}$	$5\frac{1}{8}$
March	$4\frac{1}{2}$	$4\frac{3}{4}$	6	$6\frac{1}{2}$	1.60	3.00	$1\frac{1}{4}$	$5\frac{1}{2}$	$3\frac{1}{4}$	$4\frac{5}{8}$
April	4	$4\frac{1}{4}$	6	$6\frac{1}{2}$	1.55	2.65	$1\frac{3}{8}$	$5\frac{1}{8}$	$3\frac{1}{8}$	$4\frac{1}{2}$
May	$4\frac{1}{4}$	$4\frac{1}{2}$	6	$6\frac{1}{2}$	1.60	2.50	$1\frac{1}{8}$	6	$3\frac{1}{8}$	$4\frac{7}{8}$
June	$4\frac{1}{4}$	$4\frac{1}{2}$	6	$6\frac{1}{2}$	1.60	2.75	$1\frac{5}{8}$	$5\frac{3}{8}$	$3\frac{3}{8}$	$4\frac{1}{2}$
July	$4\frac{3}{8}$	$4\frac{1}{2}$	6	$6\frac{1}{2}$	1.60	2.65	$1\frac{3}{8}$	6	$3\frac{1}{2}$	$4\frac{1}{2}$
August	$4\frac{1}{4}$	$4\frac{5}{8}$	6	$6\frac{1}{2}$	1.60	2.85	$1\frac{3}{4}$	$5\frac{7}{8}$	$4\frac{3}{4}$	$5\frac{3}{4}$
September	$4\frac{1}{2}$	$4\frac{5}{8}$	6	$6\frac{1}{2}$	1.75	3.10	$1\frac{3}{4}$	$5\frac{3}{8}$	$3\frac{1}{4}$	5
October	$4\frac{3}{8}$	$4\frac{1}{2}$	6	$6\frac{1}{2}$	1.75	2.80	$1\frac{5}{8}$	$5\frac{1}{8}$	$3\frac{1}{2}$	5
November	4	$4\frac{1}{4}$	6	$6\frac{1}{2}$	1.75	3.15	$1\frac{3}{8}$	$4\frac{7}{8}$	$3\frac{1}{4}$	$4\frac{1}{2}$
December	4	$4\frac{1}{8}$	6	$6\frac{1}{2}$	1.75	2.75	$1\frac{9}{16}$	$4\frac{3}{4}$	3	4
Year	4	$5\frac{1}{8}$	6	$6\frac{1}{2}$	1.55	3.25	$1\frac{1}{8}$	$6\frac{1}{8}$	3	$5\frac{3}{4}$
1911.										
January	$4\frac{1}{8}$	$4\frac{1}{4}$	6	$6\frac{1}{2}$	1.75	2.75	$1\frac{1}{8}$	$4\frac{3}{4}$	$3\frac{5}{8}$	$3\frac{95}{100}$
February	4	4	6	$6\frac{1}{2}$	1.75	2.60	$1\frac{1}{4}$	$4\frac{7}{8}$	$3\frac{1}{4}$	$3\frac{3}{4}$
March	$3\frac{7}{8}$	4	6	$6\frac{1}{2}$	1.75	2.60	$1\frac{3}{8}$	$4\frac{1}{2}$	3	$3\frac{1}{2}$
April	$3\frac{3}{4}$	$3\frac{7}{8}$	6	$6\frac{1}{2}$	1.75	2.75	$1\frac{5}{8}$	$4\frac{3}{8}$	3	$3\frac{3}{4}$
May	$3\frac{3}{4}$	$3\frac{7}{8}$	6	$6\frac{1}{2}$	1.75	2.75	$1\frac{5}{8}$	$4\frac{1}{4}$	$2\frac{3}{4}$	$4\frac{1}{4}$
June	$3\frac{5}{8}$	$3\frac{3}{4}$	6	$6\frac{1}{2}$	......	......	$1\frac{1}{2}$	$4\frac{3}{8}$	3	$3\frac{7}{8}$
July	$3\frac{3}{4}$	$3\frac{7}{8}$	6	$6\frac{1}{2}$	......	......	$1\frac{3}{4}$	$5\frac{3}{8}$	$3\frac{1}{8}$	$3\frac{9}{16}$
August	$3\frac{7}{8}$	4	6	$6\frac{1}{2}$	1.90	3.00	$1\frac{7}{8}$	$5\frac{3}{8}$	$3\frac{1}{2}$	$4\frac{5}{8}$
September	$4\frac{1}{8}$	$4\frac{1}{4}$	6	$6\frac{1}{2}$	1.90	3.00	$1\frac{3}{4}$	$5\frac{1}{4}$	$3\frac{1}{2}$	$4\frac{3}{4}$
October	$4\frac{1}{4}$	$4\frac{3}{8}$	6	$6\frac{1}{2}$	1.90	3.25	$1\frac{3}{8}$	$5\frac{1}{4}$	$3\frac{3}{8}$	$4\frac{3}{4}$
November	$4\frac{1}{8}$	$4\frac{1}{4}$	6	$6\frac{1}{2}$	1.90	3.35	$1\frac{7}{8}$	5	$3\frac{1}{2}$	$4\frac{5}{8}$
December	$4\frac{1}{4}$	$4\frac{1}{4}$	6	$6\frac{1}{2}$	2.15	3.50	$1\frac{7}{8}$	5	$3\frac{7}{8}$	$4\frac{1}{4}$
Year	$3\frac{5}{8}$	$4\frac{3}{8}$	6	$6\frac{1}{2}$	1.75	3.50	$1\frac{1}{8}$	$5\frac{3}{8}$	$2\frac{3}{4}$	$4\frac{3}{4}$

[1] Louisiana grade, 1898 to 1901. [2] Per barrel of 162 pounds. [3] Fancy head. [4] New crop.

RICE—Continued.

International trade in rice, 1906–1910.[1]

[Mostly cleaned rice.]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Belgium	Jan. 1	73,215,968	61,676,146	84,552,734	115,783,393	86,693,324
British India	Jan. 1	4,284,929,600	4,294,019,202	3,736,183,475	3,822,040,913	5,060,204,239
Dutch East Indies	Jan. 1	100,703,857	116,357,243	126,513,678	134,770,769	[2] 123,985,185
Formosa	Jan. 1	161,759,068	119,264,963	221,473,132	336,586,880	233,060,800
France	Jan. 1	69,981,537	98,089,781	89,998,728	101,400,020	106,500,957
French Indo-China	Jan. 1	1,623,918,163	3,033,566,212	2,462,564,329	2,396,410,076	[3] 2,396,410,076
Germany [4]	Jan. 1	300,225,203	338,463,711	318,752,101	364,511,553	243,347,211
Netherlands	Jan. 1	295,873,665	315,264,586	375,562,261	384,880,186	495,090,914
Penang	Jan. 1	279,941,999	344,022,843	330,399,949	358,252,398	[3] 358,252,398
Siam	Jan. 1	1,921,339,467	1,779,013,333	2,037,902,086	2,111,915,867	2,336,513,333
Singapore	Jan. 1	689,046,531	677,447,819	855,164,354	896,436,185	[3] 896,436,185
Other countries		682,841,706	820,990,492	809,505,000	840,332,000	[2] 834,226,000
Total		10,483,776,764	11,998,176,331	11,448,571,827	11,863,320,240	13,170,720,622

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Austria-Hungary	Jan. 1	149,879,261	129,110,161	162,192,108	196,349,949	198,824,251
Belgium	Jan. 1	149,701,442	135,585,126	183,297,724	184,379,515	183,361,579
Brazil	Jan. 1	88,821,786	25,532,770	14,920,432	23,813,514	[4] 23,813,514
British India	Jan. 1	315,943,712	237,331,883	319,184,659	229,509,261	288,013,393
Ceylon	Jan. 1	721,218,064	741,024,347	607,870,320	740,763,696	830,590,494
China	Jan. 1	624,860,267	1,702,025,200	898,215,467	506,360,667	1,254,612,533
Cuba	Jan. 1	192,766,374	258,424,609	219,077,311	240,968,236	255,748,276
Dutch East Indies	Jan. 1	762,003,092	599,813,423	732,890,254	864,187,549	[2] 1,404,190,477
Egypt	Jan. 1	101,814,530	95,461,175	102,472,583	122,966,459	90,195,852
France	Jan. 1	387,572,768	345,988,355	444,436,902	555,721,075	569,337,980
Germany [4]	Jan. 1	671,849,295	750,601,700	1,096,182,896	690,417,810	977,335,766
Japan	Jan. 1	813,478,133	902,701,867	647,138,933	441,747,600	306,209,067
Mauritius	Jan. 1	134,012,761	131,022,323	131,263,223	129,880,605	129,647,168
Netherlands	Jan. 1	561,916,461	566,643,424	673,530,815	734,620,212	781,270,101
Penang	Jan. 1	276,500,933	292,286,300	358,425,970	411,705,534	[3] 411,705,534
Philippine Islands	Jan. 1	280,101,412	262,399,906	349,175,386	368,442,959	435,025,385
Russia	Jan. 1	210,598,294	193,910,846	249,485,657	229,280,739	[2] 61,247,309
Singapore	Jan. 1	810,458,665	803,864,402	964,541,386	1,020,659,456	[3] 1,020,659,456
United Kingdom	Jan. 1	768,403,216	684,812,016	793,066,176	711,844,336	914,060,336
United States	Jan. 1	209,152,583	203,560,814	217,345,610	225,710,483	224,826,350
Other countries		1,284,847,364	1,241,719,828	1,282,690,000	1,393,420,000	[2] 1,519,702,000
Total		9,515,900,413	10,303,820,475	10,447,403,812	10,022,749,655	11,880,376,821

[1] See "General note," p. 526.
[2] Preliminary.
[3] Year preceding.
[4] Not including free ports prior to Mar. 1, 1906.

HOPS.

Hop crop of countries named, 1907–1911.

[Excluding Canada, for which the census of 1901 shows a production in the preceding year of 1,004,216 pounds. Other omitted countries are of very small production.]

Country.	1907	1908	1909	1910	1911 [1]
NORTH AMERICA.					
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
United States [2]	57,510,103	43,900,311	50,697,048	49,634,028	[3] 40,000,000
EUROPE.					
Austria-Hungary:					
Austria	29,975,000	41,331,000	18,706,000	36,402,000	21,000,000
Hungary	2,254,000	1,913,000	1,871,000	1,708,000	2,200,000
Total Austria-Hungary	32,229,000	43,244,000	20,577,000	38,110,000	23,200,000

[1] Preliminary.
[2] Commercial movement for years beginning July 1, based upon exports, imports, and internal-revenue data for hops used in brewing.
[3] Unofficial estimate.

HOPS—Continued.

Hop crop of countries named, 1907–1911—Continued.

Country.	1907	1908	1909	1910	1911
EUROPE—continued.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Belgium	6,790,000	8,530,000	3,861,000	6,300,000	5,700,000
France	8,672,000	11,369,000	5,029,000	7,126,000	4,950,000
Germany	53,255,000	58,069,000	13,356,000	44,998,000	23,430,000
Netherlands [1]	158,000	158,000	158,000	158,000	158,000
Russia	12,639,000	9,750,000	8,267,000	6,500,000	10,500,000
United Kingdom: England	41,902,000	52,725,000	24,022,000	33,900,000	36,739,000
Total	155,645,000	183,845,000	75,270,000	137,092,000	104,677,000
AUSTRALASIA.					
Australia:					
Victoria	312,000	132,000	123,000	99,000	[2] 99,000
Tasmania	1,356,000	1,402,000	1,334,000	1,160,000	1,775,000
New Zealand	[3] 1,100,000	[3] 941,000	[3] 749,000	[3] 764,000	[2] 764,000
Total	2,768,000	2,475,000	2,206,000	2,023,000	2,638,000
Grand total	215,923,103	230,220,311	128,173,048	188,749,028	147,315,000

[1] Estimated average, 1900–1903.
[2] Year preceding.
[3] Estimate based on the official figures of area, multiplied by yield as given in census of 1895, 1,088 pounds.

Wholesale prices of hops per pound, 1898–1911.

Date.	New York. Choice State. Low.	New York. Choice State. High	Cincinnati. Choice. Low.	Cincinnati. Choice. High	Chicago. Pacific coast, good to choice.[1] Low.	Chicago. Pacific coast, good to choice.[1] High
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents*
1898	11	20	14	20	5	19½
1899	12	18	13	19	7	18
1900	12½	21	10	18	6½	18
1901	13	20	13¾	17 9/10	12½	19
1902	14	38	14½	30	12½	31
1903	20½	37	24	29½	19	31
1904	32	41	28	37	28½	37
1905	13	37	13½	33	10	34
1906	11	25	12	18½	9	22
1907	12	23	[2] 12	......	[3] 6	[3] 18
1908.					(4)	(4)
January	15	16	10	......	8	11
February	13	16	9½	......	6	10
March	11	14	9	......	6	9
April	11	12	8½	......	6	8
May	11	12	8½	......	6	10
June	9	12	8½	......	6	10
July	7	11	8½	......	5	9
August	6	8	8	......	5	8
September	6	7	8	......	9	11
October	13	14	12	......	9	11
November	13	14	11	......	9	11
December	12	14	11	......	9	11
Year	6	16	8	......	5	11
1909.						
January	12	14	10	......	10	11
February	12	15	10	......	10	11
March	13	15	11	......	10	11½
April	13	15	11	......	9	11
May	13	14	11	......	10	12
June	13	17	13	......	13	15
July	15	19	14	15	13	15
August	18	19	16	17	16	18
September	18	20	20	22	25	28

Date.	New York. Choice State. Low.	New York. Choice State. High	Cincinnati. Prime. Low.	Cincinnati. Prime. High	Chicago. Pacific coast, good to choice. Low.	Chicago. Pacific coast, good to choice. High
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1909.						
October	33	39	28	......	25	29
November	34	39	28	......	24	28
December	33	36	27	28	23	27
Year	12	39	10	28	9	29
1910.						
January	33	35	25½	27½	20	26
February	32	35	25½	26½	22	26
March	28	34	24½	25½	22	24
April	24	29	24	24½	17	19
May	23	25	20	21	16	18
June	22	24	16	17	16	18
July	22	23	16	17½	14	16
August	21	23	16	17½	14	16
September	21	22	16½	......	14	16
October	21	23	15½	16½	16	17
November	22	23	16	17½	15	17
December	21	25	17½	18½	15	18
Year	21	35	15½	27½	14	26
1911.						
January	23	29	......	......	22	25
February	28	29	......	......	21	24
March	28	29	......	......	20	22
April	28	30	......	......	22	24
May	29	31	......	......	24	26
June	30	32	......	......	26	29
July	31	32	......	......	32	34
August	31	42	......	......	40	45
September	41	56	......	......	36	42
October	52	56	......	......	44	47
November	54	57	......	......	48	50
December	54	57	......	......	48	50
Year	23	57	......	......	20	50

[1] Common to choice, 1898 to 1903.
[2] Prime.
[3] Prime to choice.
[4] Pacific coast, good to choice.

HOPS—Continued.

International trade in hops, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	12,318,766	17,826,133	15,498,272	17,834,112	18,574,857
Belgium	Jan. 1	3,178,692	2,166,826	1,403,039	2,508,319	2,726,834
France	Jan. 1	382,722	386,691	152,339	163,802	180,777
Germany [2]	Jan. 1	26,767,198	22,540,055	27,341,943	19,408,417	19,115,646
Netherlands	Jan. 1	1,534,058	1,561,238	1,771,156	1,442,399	1,189,097
New Zealand	Jan. 1	493,360	288,176	170,016	347,984	[3] 347,984
Russia	Jan. 1	1,978,368	681,990	241,342	2,622,403	[4] 722,256
United Kingdom	Jan. 1	1,300,096	1,168,720	1,059,632	1,750,896	999,824
United States	Jan. 1	17,701,436	16,090,959	21,423,869	8,955,533	12,748,617
Other countries		140,828	258,296	98,000	228,000	[4] 233,000
Total		65,795,524	62,969,084	69,159,608	55,261,865	56,838,892

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Australia	Jan. 1	1,412,569	1,020,898	973,814	847,791	1,135,182
Austria-Hungary	Jan. 1	1,346,363	773,602	553,360	585,321	289,244
Belgium	Jan. 1	5,431,355	5,577,912	6,025,351	6,630,010	5,582,601
British India	Jan. 1	307,216	470,736	363,888	300,944	233,744
British South Africa	Jan. 1	657,888	588,672	543,984	435,344	532,224
Canada	Jan. 1	699,630	1,223,478	1,205,845	1,245,449	1,072,467
Denmark	Jan. 1	1,297,861	1,293,011	1,340,961	1,102,520	1,041,894
France	Jan. 1	4,386,095	4,297,911	4,907,929	5,725,567	5,153,473
Germany [2]	Jan. 1	4,865,380	6,666,336	6,154,864	8,016,587	6,990,787
Netherlands	Jan. 1	3,497,750	3,372,957	3,386,709	2,946,876	2,658,463
Russia	Jan. 1	1,452,240	1,395,110	1,283,377	1,052,183	[4] 1,372,286
Sweden	Jan. 1	1,275,477	1,488,832	1,166,003	974,140	897,045
Switzerland	Jan. 1	1,087,540	1,421,540	1,289,704	874,785	1,283,739
United Kingdom	Jan. 1	25,702,992	21,902,048	29,922,256	15,030,512	19,267,584
United States	Jan. 1	7,849,548	7,163,356	7,369,684	6,807,689	5,823,520
Other countries		4,107,343	3,465,556	3,809,000	3,761,000	[4] 3,390,000
Total		65,377,247	62,121,955	70,296,729	56,336,718	56,724,253

[1] See "General note," p. 526.
[2] Not including free ports prior to Mar. 1, 1906.
[3] Year preceding.
[4] Preliminary.

BEANS.

Area and production of beans in countries named, 1906–1910.

AREA.

Country.	1906	1907	1908	1909	1910
NORTH AMERICA.					
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	(1)	(1)	(1)	784,462	(1)
Canada:					
Prince Edward Island	(1)	(1)	200	180	164
Nova Scotia	(1)	3,098	3,100	2,900	2,793
New Brunswick	(1)	(1)	2,000	1,690	1,539
Quebec	(1)	12,379	12,000	11,600	10,657
Ontario	51,272	47,562	42,800	39,600	37,881
Mexico	(1)	(1)	(1)	(1)	(1)
SOUTH AMERICA.					
Argentina	(1)	(1)	21,763	(1)	(1)
Chile	54,273	(1)	82,227	80,913	89,355
EUROPE.					
Austria	[2] 675,708	[2] 766,332	[2] 759,664	[2] 685,274	[2] 625,845
Hungary (including Croatia-Slavonia)	2,205,992	2,045,533	1,982,923	1,964,776	1,509,190
Belgium	23,364	23,379	22,601	22,839	(1)

[1] No data.
[2] Including other pulse crops.

BEANS—Continued.

Area and production of beans in countries named, 1906–1910—Continued.

AREA—Continued.

Country.	1906	1907	1908	1909	1910
EUROPE—continued.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Bulgaria	[1] 121,249	[1] 131,787	[1] 173,085	[1] 142,395	[1] 142,456
Denmark	(2)	[1] 23,362	(2)	(2)	(2)
France	617,592	645,749	508,198	501,342	549,821
Italy	(2)	(2)	(2)	1,404,444	1,503,835
Luxemburg	3,292	3,893	4,226	4,942	4,281
Netherlands	75,740	72,374	68,780	73,206	(2)
Russia:					
Russia proper	109,345	125,831	155,747	132,786	150,530
Poland	31,450	28,828	28,512	29,813	35,570
Northern Caucasia	4,406	3,594	4,269	3,413	3,378
Servia	21,914	21,526	(2)	(2)	(2)
Spain	1,248,477	1,152,845	1,186,413	1,194,150	1,217,524
Sweden	12,135	11,241	10,838	10,922	(2)
United Kingdom:					
England	274,779	295,129	282,573	301,287	256,528
Scotland	10,994	11,430	9,572	9,172	9,493
Wales	1,300	1,572	1,083	1,347	1,363
Ireland	1,961	1,835	1,794	1,626	1,839
ASIA.					
Russia	3,577	670	478	1,941	397
AFRICA.					
Algeria	77,792	84,385	90,088	91,340	(2)
Egypt	605,496	615,510	562,728	589,355	581,939
AUSTRALASIA.					
Australia:					
New South Wales	[3] 142	[3] 124	[3] 237	[3] 274	[3] 411
Victoria	[3] 12,253	[3] 12,012	[3] 13,613	[3] 11,153	[3] 9,824
South Australia	[3] 6,690	[3] 7,149	[3] 7,397	[3] 7,054	[3] 7,999
Western Australia	[3] 920	[3] 937	[3] 903	[3] 766	[3] 704
Tasmania	145	221	226	143	210
New Zealand	2,066	1,996	1,168	1,251	(2)

PRODUCTION.

Country.	1906	1907	1908	1909	1910
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	(2)	(2)	(2)	11,145,000	(2)
Canada:					
Prince Edward Island	(2)	(2)	4,000	4,000	3,000
Nova Scotia	(2)	53,000	56,000	82,000	63,000
New Brunswick	(2)	(2)	33,000	79,000	35,000
Quebec	(2)	340,000	257,000	255,000	218,000
Ontario	980,000	815,000	895,000	905,000	859,000
Mexico	5,093,000	(2)	(2)	(2)	(2)
SOUTH AMERICA.					
Argentina	(2)	(2)	(2)	(2)	(2)
Chile	894,000	(2)	1,235,000	1,173,000	1,610,000
EUROPE.					
Austria	[1] 10,600,000	[1] 11,866,000	[1] 10,363,000	[1] 11,740,000	[1] 9,749,000
Hungary (including Croatia-Slavonia)	11,509,000	10,189,000	7,606,000	7,669,000	4,779,000
Belgium	794,000	889,000	814,000	629,000	(2)
Bulgaria	[1] 1,582,000	[1] 989,000	[1] 1,512,000	[1] 798,000	[1] 1,690,000
Denmark	[1] 534,000	[1] 359,000	[1] 544,000	[1] 502,000	[1] 536,000
France	6,710,000	8,986,000	10,031,000	9,792,000	9,638,000
Italy	(2)	(2)	24,384,000	18,725,000	20,632,000
Luxemburg	84,000	109,000	102,000	106,000	90,000
Netherlands	2,483,000	2,223,000	2,330,000	2,035,000	(2)
Roumania	[1] 3,834,000	[1] 3,430,000	[1] 3,951,000	[1] 2,722,000	3,717,000

[1] Including other pulse crops. [2] No data. [3] Includes pease.

BEANS—Continued.

Area and production of beans in countries named, 1906-1910—Continued.

PRODUCTION—Continued.

Country.	1906	1907	1908	1909	1910
EUROPE—continued.					
Russia:	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Russia proper	1,778,000	1,890,000	1,988,000	1,884,000	1,896,000
Poland	644,000	580,000	493,000	616,000	404,000
Northern Caucasia	39,000	75,000	57,000	32,000	49,000
Servia	1,516,000	1,097,000	(1)	(1)	(1)
Spain	11,909,000	9,957,000	11,217,000	12,199,000	13,454,000
Sweden	214,000	170,000	214,000	173,000	167,000
United Kingdom:					
England	9,827,000	10,488,000	8,726,000	8,832,000	8,519,000
Scotland	419,000	430,000	365,000	350,000	383,000
Wales	39,000	46,000	31,000	37,000	40,000
Ireland	101,000	85,000	74,000	75,000	80,000
ASIA.					
Russia	30,000	8,000	5,000	12,000	2,000
AFRICA.					
Algeria	776,000	988,000	780,000	1,154,000	(1)
Egypt	(1)	(1)	(1)	(1)	(1)
AUSTRALASIA.					
Australia:					
New South Wales	[2] 2,000	[2] 3,000	[2] 4,000	[2] 11,000	[2] 13,000
Victoria	[2] 274,000	[2] 296,000	[2] 221,000	[2] 204,000	[2] 146,000
South Australia	[2] 124,000	[2] 145,000	[2] 121,000	[2] 95,000	[2] 134,000
Western Australia	[2] 10,000	[2] 10,000	[2] 9,000	[2] 10,000	[2] 9,000
Tasmania	3,000	5,000	4,000	3,000	4,000
New Zealand	70,000	76,000	45,000	54,000	(1)

[1] No data. [2] Beans and peas.

PEASE.

Area and production of peas in countries named, 1906-1910.

AREA.

Country.	1906	1907	1908	1909	1910
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	(1)	(1)	(1)	1,302,402	(1)
Canada:					
Prince Edward Island	(1)	(1)	600	600	500
Nova Scotia	(1)	1,635	1,500	1,400	1,300
New Brunswick	(1)	(1)	2,700	2,400	2,300
Quebec	(1)	55,817	51,900	46,400	44,000
Ontario	410,356	340,977	354,600	341,300	336,800
Manitoba	2,559	1,684	1,600	1,200	1,200
Mexico	(1)	(1)	(1)	(1)	(1)
SOUTH AMERICA.					
Chile	2,402	(1)	11,332	12,002	(1)
EUROPE.					
Hungary (including Croatia-Slavonia)	48,004	48,886	49,980	49,153	33,434
Belgium	12,432	13,671	13,249	12,343	(1)
France	80,644	80,503	82,598	79,121	72,376
Luxemburg	2,810	2,835	2,438	2,366	2,149
Netherlands	72,475	75,483	71,786	73,974	(1)
Russia:					
Russia proper	2,775,435	2,595,367	2,838,193	2,935,319	3,174,814
Poland	422,988	409,807	399,311	399,241	396,865
Northern Caucasia	9,056	14,097	11,688	9,892	11,305
Servia	3,717	3,438	(1)	(1)	(1)
Spain	517,835	509,634	525,053	550,828	553,163
Sweden	49,153	48,135	47,508	45,360	(1)

[1] No data.

BEANS—Continued.

PEASE—Continued.

Area and production of peas in countries named, 1906–1910—Continued.

AREA—Continued.

Country.	1906	1907	1908	1909	1910
EUROPE—continued.					
United Kingdom:	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
England	148,034	159,431	153,086	168,673	151,823
Scotland	598	600	566	602	566
Wales	858	845	746	708	660
Ireland	305	324	297	264	230
ASIA.					
Russia	63,040	66,946	73,990	71,634	68,178
AFRICA.					
Algeria	19,264	20,447	21,696	22,682	(1)
AUSTRALASIA.					
Australia:					
Tasmania	12,086	10,421	12,331	12,139	15,671
New Zealand	13,211	11,519	8,416	6,993	(1)

PRODUCTION.

Country.	1906	1907	1908	1909	1910
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	(1)	(1)	(1)	7,110,000	(1)
Canada:					
Prince Edward Island	(1)	(1)	14,000	14,000	8,000
Nova Scotia	(1)	35,000	21,000	53,000	35,000
New Brunswick	(1)	(1)	24,000	63,000	55,000
Quebec	(1)	1,049,000	675,000	752,000	729,000
Ontario	7,622,000	7,597,000	6,294,000	7,239,000	5,692,000
Manitoba	69,000	28,000	32,000	24,000	19,000
Mexico	2,687,000	(1)	(1)	(1)	(1)
SOUTH AMERICA.					
Chile	40,000	(1)	128,000	119,000	(1)
EUROPE.					
Hungary (including Croatia-Slavonia)	612,000	599,000	670,000	666,000	438,000
Belgium	439,000	472,000	445,000	281,000	(1)
France	1,360,000	1,541,000	1,488,000	1,574,000	1,380,000
Luxemburg	62,000	68,000	46,000	49,000	34,000
Netherlands	2,518,000	1,993,000	2,093,000	1,452,000	(1)
Roumania	627,000	372,000	354,000	456,000	565,000
Russia:					
Russia proper	15,618,000	17,466,000	17,639,000	24,232,000	33,651,000
Poland	5,740,000	5,810,000	5,384,000	6,269,000	4,691,000
Northern Caucasia	83,000	129,000	53,000	82,000	123,000
Servia	21,000	14,000	(1)	(1)	(1)
Spain	3,445,000	2,408,000	4,933,000	4,773,000	4,970,000
Sweden	....	....	1,328,000	1,090,000	1,255,000
United Kingdom:					
England	4,616,000	4,850,000	4,470,000	4,506,000	4,098,000
Scotland	18,000	17,000	17,000	17,000	17,000
Wales	24,000	18,000	17,000	16,000	16,000
Ireland	9,000	9,000	8,000	8,000	7,000
ASIA.					
Russia	562,000	596,000	774,000	512,000	622,000
AFRICA.					
Algeria	196,000	272,000	218,000	312,000	(1)
AUSTRALASIA.					
Australia:					
Tasmania	214,000	217,000	257,000	285,000	380,000
New Zealand	407,000	347,000	250,000	309,000	(1)

[1] No data.

BEANS—Continued.

Wholesale prices of beans per bushel, 1898–1911.

Date.	Boston.		Chicago.		Detroit.		San Francisco.	
	Pea.		Pea.		Pea.		Small white (per 100 lbs.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1898	....	....	$0.78	$1.30	$0.90	$1.30	$1.25	$2.20
1899	....	....	.90	1.87	1.01	1.80	2.00	3.00
1900	....	....	1.65	2.25	1.55	2.10	2.85	4.50
1901	$2.00	$2.75	.90	2.80	1.66	2.40	2.00	5.00
1902	1.60	2.55	.85	2.49	1.28	1.98	3.30	4.65
1903	2.10	2.45	.90	2.40	1.82	2.35	2.40	3.40
1904	1.72½	2.20	.90	2.05	1.58	1.98	2.75	3.32½
1905	1.75	2.00	1.00	1.85	1.49	1.85	2.75	3.60
1906	1.50	1.80	1.10	1.65	1.27	1.61	....	....
1907	1.42	2.45	[1] 1.10	[1] 2.65	1.28	2.25	2.60	3.60
1908.								
January	2.30	2.35	1.85	2.15	2.00	2.10	3.40	3.55
February	2.35	2.40	1.75	2.40	2.10	2.30	3.40	3.60
March	2.30	2.40	1.80	2.40	2.10	2.25	3.40	3.60
April	2.35	2.45	1.65	2.32	2.25	2.42	3.40	3.60
May	2.60	2.75	1.65	2.70	2.42	2.55	3.50	4.35
June	2.65	2.75	2.00	2.70	2.47	2.60	4.20	4.50
July	2.65	2.70	2.00	2.65	2.40	2.65	4.35	4.60
August	2.60	2.70	1.90	2.54	2.50	2.65	4.60	4.75
September	2.35	2.60	1.75	2.40	2.05	2.40	4.25	4.75
October	2.35	2.40	1.75	2.40	2.10	2.18	4.00	4.50
November	2.40	2.40	1.75	2.25	2.10	2.20	4.30	4.65
December	2.35	2.40	1.75	2.27	2.15	2.15	4.35	4.70
Year	2.30	2.75	1.65	2.70	2.00	2.65	3.40	4.75
1909.								
January	2.35	2.45	1.75	2.33	2.15	2.30	4.50	4.90
February	2.45	2.55	1.80	2.50	2.25	2.40	5.10	5.30
March	2.55	2.55	2.20	2.48	2.35	2.40	5.20	5.40
April	2.50	2.55	2.25	2.58	2.36	2.50	5.35	5.65
May	2.55	2.75	2.35	2.65	2.50	2.55	5.50	6.00
June	2.70	2.75	2.50	2.67	2.50	2.55	6.00	7.00
July	2.70	2.75	2.12½	2.67	2.20	2.50	6.25	7.00
August	2.60	2.70	2.12½	2.20	2.15	2.20	6.75	7.50
September	2.35	2.50	2.12½	2.36	2.10	2.20	4.00	4.50
October	2.30	2.40	2.00	2.36	2.00	2.10	4.00	4.65
November	2.25	2.35	1.96	2.25	2.00	2.10	4.50	5.00
December	2.25	2.30	2.03	2.17	2.55	2.55	4.50	5.00
Year	2.25	2.75	1.75	2.67	2.00	2.55	4.00	7.50
1910.								
January	2.25	2.35	2.10	2.30	2.07	2.20	4.50	4.85
February	2.35	2.40	2.17	2.25	2.12	2.15	4.50	4.80
March	2.30	2.35	2.10	2.22	2.08	2.15	4.50	4.85
April	2.25	2.30	2.00	2.16	2.03	2.08	4.25	4.85
May	2.27½	2.40	2.10	2.35	2.05	2.20	4.25	4.60
June	2.40	2.45	2.15	2.40	2.22	2.30	4.00	4.50
July	2.45	2.45	2.30	2.50	2.22	2.32	3.85	4.25
August	2.45	2.60	2.43	2.78	2.32	2.40	3.85	4.10
September	2.65	2.70	2.35	2.78	2.15	2.40	3.85	4.10
October	2.45	2.65	2.00	2.55	2.02	2.15	3.60	3.90
November	2.35	2.40	2.00	2.30	2.00	2.10	3.25	3.80
December	2.30	2.35	1.85	2.30	1.92	2.09	3.25	3.50
Year	2.25	2.70	1.85	2.78	1.92	2.40	3.25	4.85
1911.								
January	2.30	2.35	1.85	2.18	2.00	2.05	3.00	3.60
February	2.20	2.30	1.90	2.18	1.90	1.92	3.25	3.50
March	2.05	2.20	1.76	2.05	1.88	1.96	3.25	3.50
April	2.10	2.15	1.76	2.10	1.95	1.96	3.40	3.50
May	2.10	2.25	1.85	2.18	1.94	2.04	3.25	3.50
June	2.20	2.25	1.85	2.38	1.87	2.20	3.25	3.55
July	2.25	2.40	1.85	2.38	2.18	2.22	3.40	3.50
August	2.40	2.50	2.08	2.45	2.13	2.28	3.45	3.75
September	2.40	2.45	2.00	2.35	2.05	2.17	3.60	3.90
October	2.40	2.65	2.17	2.55	2.15	2.40	3.50	3.85
November	2.60	2.65	2.28	2.57	2.23	2.32	3.50	4.20
December	2.50	2.65	2.25	2.50	2.15	2.32	4.00	4.15
Year	2.05	2.65	1.76	2.57	1.87	2.40	3.00	4.20

[1] Common to fine.

SUGAR.

Production of sugar in countries named, 1906–7 to 1910–11.

[All data are from official sources, except where otherwise stated. Some figures in the table refer to raw and some to refined sugar, according to the kind reported in the original returns.]

Country.	1906–7	1907–8	1908–9	1909–10	1910–11 (preliminary).
CANE SUGAR.					
NORTH AMERICA.					
United States:					
Contiguous—	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Louisiana	230,000	340,000	355,000	[1] 290,625	300,000
Texas	13,000	12,000	15,000	[1] 7,679	11,000
Noncontiguous—					
Hawaii [2]	393,000	465,000	478,000	463,000	506,000
Porto Rico [3]	184,700	186,000	224,400	279,500	291,900
Total United States	820,700	1,003,000	1,072,400	1,040,804	1,108,900
Central America:					
British Honduras	600	600	600	400	[4] 400
Costa Rica [2]	2,000	2,000	3,000	2,000	2,000
Guatemala [2]	7,000	7,000	7,000	7,000	7,000
Nicaragua	5,000	[5] 5,000	10,000	[6] 10,000	[6] 10,000
Salvador [2]	6,000	5,000	6,000	6,000	6,000
Mexico	117,600	121,300	140,900	145,600	157,500
West Indies:					
British—					
Antigua	10,800	14,800	13,300	9,200	[4] 9,200
Barbados	56,100	38,000	36,400	18,300	40,400
Dominica	100	100	100	100	[4] 100
Jamaica	31,800	28,500	24,000	18,800	12,000
Montserrat	800	400	100	100	100
St. Christopher-Nevis	15,900	14,900	11,700	12,300	13,200
St. Lucia	5,400	5,000	5,500	5,000	[4] 5,000
St. Vincent	300	200	200	300	[4] 300
Trinidad and Tobago	63,000	50,600	48,900	53,000	52,000
Cuba	1,441,900	969,300	1,521,800	1,817,500	1,500,000
Danish [7]	12,000	12,600	4,400	11,900	11,600
French—					
Guadeloupe [7]	38,300	35,500	24,800	42,200	[4] 42,200
Martinique [7]	36,300	35,400	37,400	[6] 37,400	[6] 37,400
Santo Domingo [7]	56,000	62,200	69,500	91,400	[4] 91,400
Total	2,727,600	2,411,400	3,038,000	3,329,304	3,106,700
SOUTH AMERICA.					
Argentina [8]	116,900	111,600	159,100	125,300	146,200
Brazil [2]	261,000	194,000	244,000	249,000	282,000
Guiana:					
British [9]	100,700	115,200	108,500	101,000	108,300
Dutch	12,400	11,700	11,800	10,800	[4] 10,800
Peru [2]	159,000	133,000	148,000	148,000	162,000
Total	650,000	565,500	671,400	634,100	709,300
EUROPE.					
Spain	15,500	15,800	13,800	21,300	22,600
ASIA.					
British India [10]	2,205,300	2,046,900	1,872,900	2,127,100	2,226,400
Federated Malay States:					
Perak	[11] 12,000	12,200	11,400	[11] 12,000	[11] 12,000
Formosa	62,900	64,500	120,400	[6] 120,400	[6] 120,400
Japan	50,000	49,200	53,100	57,900	[4] 57,900
Java	1,051,000	1,191,000	1,222,000	1,222,000	1,234,000
Philippine Islands [12]	118,400	149,300	110,600	125,700	147,000
Total	3,499,600	3,513,100	3,390,400	3,665,100	3,797,700

1 Preliminary census returns.
2 Unofficial.
3 Shipments (domestic) to the United States for calendar year in which crop year ends.
4 Year preceding.
5 Data for 1906–7.
6 Data for 1908–9.
7 Exports.
8 Sugar on which internal-revenue tax was paid.
9 Exports for year ending March 31.
10 The figures represent the production of about 97 per cent of the area under sugar cane and 90 per cent of the area under all sugar crops, during 1906–7 to 1909–10.
11 Average production 1907–8 and 1908–9.
12 Exports for year ending June 30.

SUGAR—Continued.

Production of sugar in countries named, 1906-7 to 1910-11—Continued.

Countries.	1906-7	1907-8	1908-9	1909-10	1910-11 (preliminary).
CANE SUGAR—Contin.					
AFRICA.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Egypt [1]	42,000	55,000	49,000	52,000	54,000
Mauritius	216,700	161,500	192,800	248,000	219,300
Natal	24,200	32,000	77,500	[2] 77,500	[2] 77,500
Reunion [3]	45,800	46,500	38,800	[1] 39,000	[1] 43,000
Total	328,700	295,000	358,100	416,500	393,800
OCEANIA.					
Australia:					
Queensland	182,200	185,100	150,400	132,800	210,800
New South Wales	23,400	29,200	15,300	14,700	18,800
Fiji	41,900	68,300	66,100	68,900	61,800
Total	247,500	282,600	231,800	216,400	291,400
Total cane sugar	7,468,900	7,083,400	7,703,500	8,282,704	8,321,500
BEET SUGAR.					
NORTH AMERICA.					
United States: Contiguous	432,000	414,000	380,000	[4] 447,946	456,000
Canada: [5]					
Ontario	9,300	9,400	[6] 9,400	[6] 9,400	[6] 9,400
Total	441,300	423,400	389,400	457,346	465,400
EUROPE.					
Austria-Hungary [7]	1,309,600	1,389,300	1,365,000	1,225,900	1,498,700
Belgium	273,400	223,400	243,700	235,600	267,000
Bulgaria [1]	3,000	3,000	6,000	4,000	3,000
Denmark	65,200	51,800	65,300	61,800	107,300
France [8]	661,900	637,000	701,400	711,500	630,000
Germany	2,206,600	2,104,900	2,046,400	2,005,200	2,548,900
Greece [1]	1,000	400	1,000	[2] 1,000	[2] 1,000
Italy [1]	105,000	134,000	163,000	109,000	181,000
Netherlands	162,000	156,000	194,000	178,000	213,000
Roumania [1]	29,000	21,000	25,000	30,000	49,000
Russia [9]	1,266,400	1,232,800	1,109,100	1,002,400	1,881,600
Servia [10]	7,300	7,300	7,300	7,300	7,300
Spain [1]	80,000	93,000	107,000	85,000	70,000
Sweden [1]	160,000	110,000	134,000	125,000	171,100
Switzerland [10]	2,700	2,700	2,700	2,700	2,700
Total	6,333,100	6,166,600	6,170,900	5,784,400	7,631,600
Total beet sugar	6,774,400	6,590,000	6,560,300	6,241,746	8,097,000
Total beet and cane sugar	14,243,300	13,673,400	14,263,800	14,524,450	16,418,500

[1] Unofficial.
[2] Data for 1908-9.
[3] Exports for calendar year in which crop year ends.
[4] Preliminary census returns; 496,800 short tons of "granulated" and 4,900 of "raw" beet sugar.
[5] In addition to Ontario; Alberta produced 2,230 long tons in 1907-8.
[6] Data for 1907-8.
[7] Estimate as returned by Central Union for Beet Sugar Industry
[8] In terms of refined sugar. Total production of sugar and molasses in terms of refined sugar: 1906-7, 672,060 long tons; 1907-8, 646,452; 1908-9, 711,654; 1909-10, 722,303; 1910-11, 640,208 long tons.
[9] Sugar made from beets entering factories.
[10] Average production as unofficially estimated.

SUGAR—Continued.

Production of sugar in the United States and its possessions, 1839–40 to 1910–11.

[Census data, as far as available, are given in *italics*. Census of 1840 did not separate cane and maple sugar; statistics for "Other Southern States" represent production of all sugar in South Carolina, Georgia, Florida, Tennessee, Alabama, and Mississippi. Censuses of 1850 and 1860 give returns in "Hogsheads of 1,000 pounds" and Censuses of 1870 and 1880 in "Hogsheads;" these returns were converted into pounds, in Census Abstract of 1890 at rate of 1,200 pounds to the hogshead and in Census of 1900 at rate of 1,000 pounds. Beet-sugar production for 1897–98, for 1901–2 and later years from United States Department of Agriculture reports; for other years from Willett & Gray. Production of cane sugar in Louisiana beginning 1906–7, and in Texas beginning 1903–4, from Willett & Gray; earlier statistics for Louisiana and other Southern States from Bouchereau, in part taken directly from his reports and in part from the Statistical Abstract of the United States. Porto Rican production of cane sugar for 1854–55 to 1884–85 from Rueb & Co.; 1885-86 to 1899-1900 from Willett & Gray for later years shipments from Porto Rico to the United States. Statistics for Hawaii, 1874–75 to 1880–81, represent exports from Bureau of Statistics Bul. 30; for 1881–82 to 1884–85 from Rüeb & Co.; for later years from Willett & Gray. Statistics for Philippine Islands for 1854–55 to 1857–58, 1859–60 to 1866–67, 1872–73 to 1894–95 represent exports as officially returned, taken from the Census of the Philippine Islands, 1903; for 1858–59, 1867–68 to 1871–72 from Foreign Markets Bul. 14, representing commercial estimates of exports; 1894–95 to 1898–99, exports from Willett & Gray; subsequent to 1898–99 (except the Census crop of 1902), exports from official sources.]

Year.	Beet sugar.	Cane sugar.					Total.
		Louisiana.	Other Southern States.	Porto Rico.	Hawaii.	Philippine Islands.	
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1839–40 [1]	....	*53,548*	*403*	....	....	....	....
1849–50 [1]	....	*Hogsheads.* *226,001*	*Hogsheads.* *21,576*	....	....	....	....
1854–55	....	*Long tons.* 171,976	*Long tons.* 13,169	58,377	....	35,008	278,530
1855–56	....	113,647	9,821	82,000	....	47,397	252,865
1856–57	....	36,327	2,673	85,000	....	36,066	160,066
1857–58	....	137,351	6,385	69,444	....	26,858	240,038
1858–59	....	185,177	8,169	58,000	....	50,095	301,441
1859–60	....	113,891	5,149	57,000	....	49,013	225,053
1859–60 [1]	....	*Hogsheads.* *221,726*	*Hogsheads.* *9,256*	....	....	....	....
1860–61	....	*Long tons.* 118,332	*Long tons.* 4,313	67,000	....	45,316	234,961
1861–62	....	235,858	5,138	68,000	....	60,957	369,953
1862–63	....	43,232	2,768	63,000	....	51,240	160,240
1863–64		37,723	250	61,590	....	44,325	144,288
1864–65		4,821	179	63,375	....	46,092	114,867
1865–66		8,884	348	64,417	....	40,636	114,685
1866–67		19,152	3,348	68,229	....	55,195	146,324
1867–68		18,482	4,518	73,935	....	74,081	171,416
1868–69	[2] 400	42,434	2,567	81,500	....	68,818	195,719
1869–70		44,399	2,402	102,110	....	78,214	227,525
1869–70 [1]		*Hogsheads.* *80,706*	*Hogsheads.* *6,337*	....	....	....	....
1870–71		*Long tons.* 75,392	*Long tons.* 4,208	103,304	....	87,465	270,769
1871–72		65,583	4,217	89,559	....	95,526	255,285
1872–73	500	55,958	4,235	87,639	....	83,865	232,197
1873–74	700	46,090	2,410	71,755	....	99,770	220,725
1874–75		60,047	3,454	72,128	11,197	126,089	273,015
1875–76	[3] 100	72,954	4,046	70,016	11,639	128,485	287,240
1876–77		85,122	3,879	62,340	11,418	121,052	283,911
1877–78		65,671	5,330	84,347	17,157	120,096	292,701
1878–79	200	106,910	5,090	76,411	21,884	129,777	340,272
1879–80	1,200	88,822	3,980	57,057	28,386	178,329	357,774
1879–80 [1]	....	*Hogsheads.* *171,706*	*Hogsheads.* *7,166*	....	....	....	....
1880–81	500	*Long tons.* 121,867	*Long tons.* 5,500	61,715	41,870	205,508	436,960
1881–82	[3] 500	71,373	5,000	80,066	50,972	148,047	355,958
1882–83		135,297	7,000	77,632	51,705	193,726	465,860
1883–84	535	128,443	6,800	98,665	63,948	120,199	418,590
1884–85	953	94,376	6,500	70,000	76,496	200,997	449,322
1885–86	600	127,958	7,200	64,000	96,500	182,019	478,277
1886–87	800	80,859	4,535	86,000	95,000	169,040	436,234
1887–88	255	157,971	9,843	60,000	100,000	158,445	486,514
1888–89	1,861	144,878	9,031	62,000	120,000	224,861	562,631
1889–90	2,203	128,344	8,159	55,000	120,000	142,554	456,260
1889–90 [1]	....	*130,413*	*4,089*	....	....	....	....

[1] Census figures.
[2] Mean annual production; quantity varied from year to year between 300 and 500 tons.
[3] Production uncertain; not exceeding quantity stated.

SUGAR—Continued.

Production of sugar in the United States and its possessions, 1839-40 to 1910-11—Con.

Year.	Beet sugar.	Cane sugar.					Total.
		Louisiana.	Other Southern States.	Porto Rico.	Hawaii.	Philippine Islands.	
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1890-91	3,459	215,844	6,107	50,000	125,000	136,035	536,445
1891-92	5,356	160,937	4,500	70,000	115,598	248,806	605,197
1892-93	12,018	217,525	5,000	50,000	140,000	257,392	681,935
1893-94	19,950	265,836	6,854	60,000	136,689	207,319	696,648
1894-95	20,092	317,334	8,288	52,500	131,698	336,076	865,988
1895-96	29,220	237,721	4,973	50,000	201,632	230,000	753,546
1896-97	37,536	282,009	5,570	58,000	224,218	202,000	809,333
1897-98	40,398	310,447	5,737	54,000	204,833	178,000	793,415
1898-99	32,471	245,512	3,442	53,826	252,507	93,000	680,758
1898-99 [1]		*248,658*	[2] *5,266*				
1899-1900	72,944	147,164	2,027	35,000	258,521	73,193	588,849
1899-1900 [1]	*72,972*	*142,485*	*1,510*		*242,008*		
1900-1901	76,859	275,579	2,891	72,800	321,461	55,244	804,834
1901-2	164,827	321,676	3,614	92,100	317,509	66,974	966,700
1902-3	195,005	329,227	3,722	89,800	391,062	109,918	1,118,734
1902 [1]						*177,371*	
1903-4	214,825	228,477	[2] 19,800	123,300	328,003	73,978	988,383
1904-5	216,173	355,531	[2] 15,000	134,900	380,576	111,849	1,214,029
1904-5 [1]	*226,715*						
1905-6	279,393	336,752	[2] 12,000	191,500	383,225	123,790	1,326,660
1906-7	431,796	230,000	[2] 13,000	184,700	392,871	118,395	1,370,762
1907-8	413,954	340,000	[2] 12,000	186,000	465,288	149,323	1,566,565
1908-9	380,254	355,000	[2] 15,000	224,400	477,817	110,604	1,563,075
1909 [1, 3]	*447,946*	*290,625*	[2] *7,679*				
1909-10	457,562	325,000	[2] 10,000	279,500	462,613	125,699	1,660,374
1910-11	455,511	300,000	[2] 11,000	291,900	506,096	147,016	1,711,523
1911-12 [3]	[4] 540,000	300,000	[2] 8,000	[4] 350,000	500,000	[4] 225,000	1,923,000

[1] Census figures. [2] Texas. [3] Preliminary. [4] Commercial estimate.

Sugar-beet and beet-sugar production of the United States, 1911-1901.

State and year.	Factories in operation.	Area harvested.	Average yield of beets per acre.	Beets worked.	Sugar manufactured.	Average extraction of sugar based on weight of beets.	Average sugar in beets.	Average purity coefficient of beets.[1]	Average length of campaign.
1911 (preliminary):[2]		*Acres.*	*Tons.*[3]	*Tons.*[3]	*Pounds.*	*Per cent.*	*P. cent.*	*P. cent.*	*Days.*
California	10	99,163	10.72	[4] 1,063,386	328,160,000	[5] 15.43	18.54		96
Colorado	17	86,285	11.20	[4] 966,699	236,454,000	[5] 12.23	15.58		61
Michigan	17	145,837	9.98	[4] 1,455,256	302,694,000	[5] 10.40	14.49		122
Utah and Idaho	9	51,002	12.72	[4] 648,677	166,972,000	[5] 12.87	16.47		94
Wisconsin	4	23,241	11.02	[4] 256,124	51,890,000	[5] 10.13	14.35		106
Other States	12	64,264	10.73	[4] 689,531	152,110,000	[5] 11.03	14.60		83
Total and average	69	469,792	10.81	[4] 5,079,673	1,238,280,000	[5] 12.19	15.81		93
1910	61	398,029	10.17	4,047,292	1,020,344,000	12.61	16.35	84.35	83
1909	65	420,262	9.71	4,081,382	1,024,938,000	12.56	16.10	84.11	83
1908	62	364,913	9.36	3,414,891	851,768,000	12.47	15.74	83.5	74
1907	63	370,984	10.16	3,767,871	927,256,430	12.30	15.8	83.6	89
1906	63	376,074	11.26	4,236,112	967,224,000	11.42	14.9	82.2	105
1905	52	307,364	8.67	2 665,913	625,841,228	11.74	15.3	83.0	77
1904	48	197,784	10.47	2,071,539	484,226,430	11.69	15.3	83.1	78
1903	49	242,576	8.56	2,076,494	481,209,087	11.59	[6] 15.1	([7])	75
1902	41	[8] 216,400	8.76	1,895,812	436,811,685	11.52	[6] 14.6	[6] 83.3	94
1901	36	175,083	9.63	1,685,689	369,211,733	10.95	14.8	82.2	88

[1] By purity coefficient is meant the percentage of sugar in the total solids of the substance tested, whether it be beets, juice, or sugar. In this table it represents the average percentage of sugar in the total solids of the beets as determined by tests made at the factories.
[2] Data for 1911 were furnished by the Bureau of Plant Industry, Department of Agriculture.
[3] Tons of 2,000 pounds each.
[4] Beets "delivered to factories."
[5] Estimated.
[6] These averages are not based on data for all the factories; some of them failed to report results of tests, but it is believed that they fairly represent the character of the total beet crops.
[7] No data reported.
[8] Based on reports from 27 factories and careful estimates for 14 others.

SUGAR—Continued.

Wholesale prices of sugar per pound, by months, on New York market, 1907–1911.

Date.	Raw.				Refined.									
	Muscovado, 89° polarization.		Centrifugal, 96° polarization.		Cut loaf.		Powdered.		Granulated, fine or standard.		Soft sugar No. 1.		Soft sugar No. 15.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1907.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	2.98	3.12	3.48	3.62	5.50	5.50	4.90	4.90	4.80	4.80	4.45	4.45	3.85	3.85
February	2.88	3.00	3.38	3.50	5.40	5.50	4.80	4.90	4.80	4.80	4.45	4.45	3.85	3.85
March	2.88	3.15	3.38	3.65	5.40	5.40	4.80	4.80	4.80	4.80	4.45	4.45	3.85	3.85
April	3.10	3.27	3.55	3.76	5.40	5.50	4.80	4.90	4.70	4.80	4.45	4.55	3.85	3.95
May	3.24	3.63	3.74	3.93	5.50	5.70	4.90	5.10	4.80	5.00	4.55	4.75	3.95	4.15
June	3.21	3.40	3.71	3.90	5.70	5.70	5.10	5.10	5.00	5.00	4.75	4.75	4.15	4.15
July	3.34	3.44	3.84	3.94	5.60	5.70	5.00	5.10	4.90	5.00	4.65	4.75	4.05	4.15
August	3.25	3.44	3.89	3.98	5.70	5.70	5.10	5.10	5.00	5.00	4.75	4.75	4.15	4.15
September	3.42	3.45	3.92	3.95	5.70	5.70	5.10	5.10	5.00	5.00	4.75	4.75	4.15	4.15
October	3.40	3.45	3.90	3.95	5.70	5.70	5.10	5.10	5.00	5.00	4.75	4.75	4.15	4.15
November	3.10	3.50	3.61	3.90	5.50	5.70	4.90	5.10	4.80	5.00	4.55	4.75	3.95	4.15
December	3.12	3.35	3.62	3.85	5.45	5.60	4.85	4.90	4.75	4.80	4.50	4.55	3.90	3.95
1908.														
January	3.27	3.45	3.77	3.95	5.60	5.70	4.90	5.00	4.80	4.90	4.55	4.65	3.95	4.05
February	3.17	3.38	3.67	3.88	5.60	5.70	4.90	5.00	4.80	4.90	4.55	4.65	3.95	4.05
March	3.36	3.86	3.86	4.36	5.70	6.20	5.00	5.50	4.90	5.40	4.65	5.15	4.05	4.55
April	3.86	3.98	4.36	4.48	6.20	6.30	5.50	5.60	5.40	5.50	5.15	5.25	4.55	4.65
May	3.74	3.92	4.24	4.42	6.20	6.30	5.50	5.60	5.40	5.50	5.15	5.25	4.55	4.65
June	3.75	3.92	4.25	4.42	6.20	6.20	5.50	5.50	5.40	5.40	5.15	5.15	4.55	4.55
July	3.67	3.92	4.17	4.42	6.10	6.20	5.40	5.50	5.30	5.40	5.05	5.15	4.45	4.55
August	3.40	3.75	3.90	4.25	5.80	6.10	5.10	5.40	5.00	5.30	4.75	5.05	4.15	4.45
September	3.40	3.48	3.90	3.98	5.80	6.00	5.10	5.30	5.00	5.20	4.75	4.95	4.15	4.35
October	3.46	3.59	3.96	4.09	5.80	6.00	5.10	5.30	5.00	5.20	4.75	4.95	4.15	4.35
November	3.42	3.48	3.92	3.98	5.60	5.90	4.90	5.20	4.80	5.10	4.55	4.85	3.95	4.25
December	3.17	3.42	3.67	3.92	5.45	5.70	4.75	5.00	4.65	4.90	4.40	4.65	3.80	4.05
1909.														
January	3.17	3.25	3.67	3.75	5.45	5.45	4.75	4.75	4.65	4.65	4.40	4.45	3.80	3.85
February	3.11	3.24	3.61	3.74	5.35	5.45	4.65	4.75	4.55	4.65	4.30	4.40	3.70	3.85
March	3.24	3.50	3.74	4.00	5.45	5.75	4.75	5.05	4.65	4.95	4.40	4.70	3.80	4.10
April	3.36	3.55	3.86	4.05	5.75	5.85	5.05	5.15	4.95	5.05	4.70	4.80	4.10	4.20
May	3.36	3.45	3.86	3.95	5.75	5.85	5.05	5.15	4.95	5.05	4.70	4.80	4.10	4.25
June	3.36	3.42	3.86	3.92	5.75	5.75	5.05	5.05	4.95	4.95	4.70	4.70	4.10	4.10
July	3.42	3.52	3.92	4.02	5.65	5.75	4.95	5.05	4.85	4.95	4.60	4.70	4.00	4.10
August	3.52	3.66	4.02	4.11	5.75	5.85	5.05	5.15	4.95	5.05	4.70	4.80	4.10	4.20
September	3.65	3.74	4.11	4.24	5.85	6.10	5.15	5.40	5.05	5.30	4.80	5.05	4.20	4.45
October	3.70	3.90	4.20	4.40	5.95	5.95	5.25	5.25	5.15	5.15	4.95	4.95	4.30	4.30
November	3.80	3.95	4.30	4.45	5.95	6.05	5.25	5.35	5.15	5.25	4.95	5.00	4.30	4.40
December	3.52	3.83	4.02	4.33	5.75	6.05	5.05	5.35	4.95	5.25	4.70	5.00	4.10	4.40
1910.														
January	3.52	3.68	4.02	4.18	5.75	5.95	5.05	5.25	4.95	5.15	4.70	4.90	4.10	4.30
February	3.58	3.86	4.08	4.36	5.95	6.05	5.25	5.35	5.15	5.25	4.90	5.00	4.30	4.40
March	3.86	3.92	4.36	4.42	6.05	6.05	5.35	5.35	5.25	5.25	5.00	5.00	4.40	4.40
April	3.74	3.86	4.24	4.36	5.95	6.05	5.25	5.35	5.15	5.25	4.90	5.00	4.30	4.40
May	3.74	3.83	4.24	4.33	5.95	6.05	5.25	5.35	5.15	5.25	4.90	5.00	4.30	4.40
June	3.67	3.80	4.17	4.30	5.95	6.05	5.25	5.35	5.15	5.25	4.90	5.00	4.30	4.40
July	3.80	3.86	4.30	4.36	5.95	5.95	5.25	5.25	5.15	5.15	4.90	4.90	4.30	4.30
August	3.80	3.98	4.30	4.48	5.95	6.05	5.25	5.35	5.15	5.25	4.90	5.10	4.30	4.50
September	3.55	3.92	4.05	4.42	5.85	6.05	5.15	5.35	5.05	5.25	4.80	5.10	4.20	4.50
October	3.30	3.50	3.80	4.00	5.45	5.85	4.75	5.15	4.65	5.05	4.40	4.80	3.80	4.20
November	3.30	3.43	3.80	3.93	5.40	5.45	4.70	4.75	4.60	4.65	4.35	4.40	3.75	3.80
December	3.43	3.55	3.93	4.05	5.40	5.70	4.70	5.00	4.60	4.90	4.35	4.65	3.75	4.05
1911.														
January	2.92	3.36	3.42	3.86	5.50	5.60	4.80	4.90	4.70	4.80	4.55	4.55	3.95	3.95
February	2.95	3.30	3.45	3.80	5.40	5.50	4.70	4.80	4.60	4.70	4.45	4.55	3.85	3.95
March	3.17	3.42	3.67	3.92	5.50	5.60	4.80	4.90	4.70	4.80	4.55	4.65	3.95	4.05
April	3.36	3.42	3.86	3.92	5.60	5.70	4.90	5.00	4.80	4.90	4.65	4.75	4.05	4.15
May	3.30	3.36	3.80	3.86	5.70	5.70	5.00	5.00	4.90	4.90	4.75	4.75	4.15	4.15
June	3.36	3.80	3.83	3.98	5.70	5.80	5.00	5.10	4.90	5.00	4.75	4.85	4.15	4.25
July	3.48	4.20	3.98	4.70	5.80	6.45	5.10	5.75	5.00	5.65	4.85	5.50	4.25	4.90
August	4.11	4.86	4.61	5.36	6.45	6.95	5.75	6.25	5.65	6.20	5.50	6.00	4.90	5.40
September	4.75	5.46	5.25	5.96	7.05	7.55	6.35	6.85	6.25	6.80	6.15	6.60	5.50	6.00
October	5.24	5.46	5.74	5.96	7.40	7.55	6.70	6.85	6.65	6.80	6.45	6.60	5.85	6.00
November	4.56	5.24	5.06	5.74	6.90	7.40	6.20	6.70	6.15	6.65	5.95	6.45	5.35	5.85
December	4.11	4.56	4.61	5.06	6.65	6.80	5.85	6.10	5.80	6.05	5.60	5.85	4.90	5.25

SUGAR—Continued.

International trade in sugar, 1906–1909.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	233,690	140,653	40,622	87,576	122,915
Austria-Hungary	Jan. 1	1,631,945,421	1,618,876,642	1,769,027,274	1,757,062,893	1,486,611,604
Belgium	Jan. 1	461,654,633	379,565,923	293,149,310	319,319,090	265,264,520
Brazil	Jan. 1	187,278,992	28,346,807	69,616,218	150,978,352	129,683,390
British Guiana	Apr. 1	257,490,240	225,650,880	258,077,120	243,113,920	[2] 226,136,960
British India	Jan. 1	46,609,920	46,583,376	46,355,008	36,905,904	51,385,600
China	Jan. 1	23,106,000	14,894,000	32,200,000	22,586,400	35,451,600
Cuba	Jan. 1	2,643,700,975	2,910,438,045	1,991,018,068	3,206,646,443	3,865,742,384
Dutch East Indies	Jan. 1	2,197,208,868	2,632,250,558	2,823,722,228	2,773,927,868	[2] 2,893,876,058
Egypt	Jan. 1	10,495,854	9,206,628	8,638,977	9,886,572	14,914,473
Formosa	Jan. 1	147,283,970	124,809,731	137,148,777	279,662,208	416,588,032
France	Jan. 1	617,793,487	731,268,080	540,824,641	535,757,483	423,779,235
Germany [3]	Jan. 1	2,671,855,698	2,015,279,142	1,842,130,114	1,882,598,329	1,543,202,143
Mauritius	Jan. 1	410,919,376	431,348,726	434,420,571	395,399,878	475,894,272
Netherlands	Jan. 1	360,050,106	299,971,063	339,798,814	336,095,311	321,262,870
Peru	Jan. 1	301,435,777	243,864,933	275,339,613	276,350,900	[4] 276,350,900
Philippine Islands	Jan. 1	285,393,647	282,006,295	319,082,784	285,116,244	267,796,166
Reunion	Jan. 1	80,424,062	102,514,264	104,133,256	86,815,236	[4] 86,815,236
Russia	Jan. 1	214,041,360	396,915,568	658,262,999	451,906,732	[2] 328,554,254
Trinidad and Tobago	Apr. 1	100,809,856	103,645,472	88,744,320	101,539,200	103,594,736
Other countries		1,093,894,758	1,033,443,798	985,775,000	1,044,777,000	[2] 1,317,861,000
Total		13,743,626,690	13,631,020,584	13,017,505,714	14,196,533,539	14,530,888,348

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Argentina	Jan. 1	4,272,159	95,950,271	91,654,477	43,683,759	125,384,925
Australia	Jan. 1	94,026,128	13,891,696	43,918,224	223,324,304	76,178,592
British India	Jan. 1	1,222,706,352	1,073,977,072	1,185,089,696	1,254,059,776	1,346,734,816
British South Africa	Jan. 1	112,856,109	106,466,060	91,486,806	67,321,877	60,347,661
Canada	Jan. 1	461,680,563	445,001,150	439,310,821	522,558,227	534,481,772
Chile	Jan. 1	118,266,828	124,648,777	106,660,995	153,762,051	158,363,803
China	Jan. 1	872,765,600	763,184,133	554,967,466	730,422,533	574,843,733
Denmark	Jan. 1	45,473,415	53,256,502	82,816,565	84,324,407	50,303,020
Egypt	Jan. 1	76,321,099	54,872,620	117,407,689	108,403,341	71,017,820
Finland	Jan. 1	83,322,752	87,685,848	90,169,703	97,576,050	96,085,928
France	Jan. 1	222,562,321	238,168,985	254,266,538	238,557,561	306,543,016
Italy	Jan. 1	31,832,317	52,332,876	10,795,373	26,113,267	14,431,091
Japan	Jan. 1	504,816,933	439,518,000	443,138,800	298,867,600	267,126,133
Netherlands	Jan. 1	121,994,196	196,542,746	141,159,438	156,036,526	141,672,455
New Zealand	Jan. 1	93,329,376	118,135,248	102,663,680	116,441,136	115,486,560
Norway	Jan. 1	80,364,138	87,092,424	87,074,147	98,677,191	101,796,435
Persia	Mar. 21	209,477,168	191,423,247	187,302,229	201,246,499	[4] 201,246,499
Portugal	Jan. 1	72,092,109	72,965,925	73,321,464	77,187,757	72,565,350
Singapore	Jan. 1	134,471,066	102,563,467	91,263,733	125,340,267	[4] 125,340,267
Switzerland	Jan. 1	187,653,456	205,551,900	201,421,100	201,007,271	223,342,955
Turkey [5]	Mar. 14	302,621,963	302,621,963	302,621,963	302,621,963	302,621,963
United Kingdom	Jan. 1	3,420,616,976	3,535,722,624	3,495,191,616	3,663,325,456	3,587,888,864
United States	Jan. 1	3,873,665,661	3,872,221,493	3,718,700,796	3,816,896,855	4,195,075,830
Uruguay	July 1	47,969,665	3,904,846	57,086,651	[6] 57,086,651	[6] 57,086,651
Other countries		438,310,189	531,965,044	595,478,000	610,738,000	[2] 641,775,000
Total		12,833,468,539	12,769,664,917	12,564,967,970	13,275,580,325	13,447,741,139

[1] See "General note," p. 526.
[2] Preliminary.
[3] Not including free ports prior to Mar. 1, 1906.
[4] Year preceding.
[5] Data for 1899.
[6] Data for 1908.

TEA.

International trade in tea, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
British India	Jan. 1	235,340,922	234,739,991	231,016,817	244,240,817	258,871,274
Ceylon	Jan. 1	170,527,126	179,843,462	179,398,312	192,886,545	182,070,094
China	Jan. 1	187,217,067	214,683,333	210,151,467	199,497,467	207,324,667
Dutch East Indies	Jan. 1	26,516,239	30,240,868	34,723,915	35,956,400	[2] 33,806,970
Formosa	Jan. 1	23,018,508	22,975,068	23,357,273	23,672,748	24,240,835
Japan	Jan. 1	32,988,115	35,354,752	31,057,906	36,949,618	39,826,886
Singapore	Jan. 1	2,396,667	2,521,333	2,266,400	2,257,333	[3] 2,257,333
Other countries		29,172,988	8,091,211	6,830,000	5,577,000	[2] 4,898,000
Total		707,177,632	728,450,018	718,802,090	741,037,928	753,296,059

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Argentina	Jan. 1	2,875,363	2,833,671	4,145,415	3,792,494	3,755,119
Australia	Jan. 1	29,478,614	35,174,152	29,873,772	31,617,111	36,727,700
Austria-Hungary	Jan. 1	2,859,615	3,090,439	3,104,320	3,183,442	3,019,420
British India	Jan. 1	5,426,731	5,965,738	7,598,559	3,615,261	4,406,394
British South Africa	Jan. 1	4,823,363	4,613,177	4,613,065	4,364,868	5,139,350
Canada	Jan. 1	26,478,242	28,840,872	30,772,138	40,143,248	37,480,954
Chile	Jan. 1	2,904,127	2,380,893	2,320,521	2,832,664	3,564,781
Dutch East Indies	Jan. 1	5,113,929	5,443,220	5,740,269	5,774,441	[2] 6,112,770
France	Jan. 1	2,519,330	2,546,083	2,502,557	2,732,381	2,781,103
French Indo-China	Jan. 1	2,399,784	2,754,303	2,964,568	2,693,845	[3] 2,693,845
Germany [4]	Jan. 1	8,675,188	8,680,920	8,828,188	10,937,462	6,894,005
Netherlands	Jan. 1	9,559,206	9,202,811	10,234,107	10,299,053	10,955,943
New Zealand	Jan. 1	6,140,842	6,771,169	6,471,965	7,302,310	7,586,816
Persia	Mar. 21	5,410,358	9,782,414	7,477,782	8,127,241	[3] 8,127,241
Russia	Jan. 1	207,529,861	204,713,749	192,109,515	162,348,704	[3] 162,348,704
Singapore	Jan. 1	4,992,267	4,842,133	4,763,867	5,191,600	[3] 5,191,600
United Kingdom	Jan. 1	270,123,489	273,984,050	275,417,319	283,547,798	287,078,453
United States	Jan. 1	89,437,757	99,117,343	90,930,621	104,484,550	98,108,939
Other countries		32,070,924	44,263,232	40,958,000	43,586,000	[2] 45,703,000
Total		718,818,990	755,000,369	730,826,548	736,574,473	737,676,137

[1] See "General note," p. 526.
[2] Preliminary.
[3] Year preceding.
[4] Not including free ports prior to Mar. 1, 1906.

Wholesale prices of tea per pound, by months, on New York market, 1907–1911.

Date.	Foochow, fair to fine.		Formosa, fine to choice.		Japans, pan fired.		India-orange pekoe.		Ceylon-orange pekoe.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1907.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	9½	21	22	38	14½	31	19¼	25¼	19	28
February	9½	21	22	38	14½	31	15	25	16	28
March	9½	21	22	38	22	31	15	25	16	28
April	9½	21	22	38	14½	31	15	25	16	28
May	9½	21	22	38	14½	31	15	25	16	28
June	9½	21	22	38	16	34	15	25	16	28
July	9½	21	22	38	16	34	15	25	16	28
August	9½	21	22	38	19½	35	15	25	16	28
September	9½	21	22	38	18½	35	15	25	16	28
October	10¼	21	22	35	18½	35	15	25	16	28
November	10¼	21	22	38	18½	35	15	25	16	28
December	12	21	22	38	18½	35	15	25	18	30
1908.										
January	13	21	22	45	19	34	17	25	18	30
February	13	21	22	45	19	35	17	25	18	30
March	13	21	22	45	19	34	17	25	18	30
April	13	21	22	45	18	34	17	25	18	30
May	13	21	22	45	18	34	17	25	18	30
June	13	21	22	45	18	35	17	25	18	30
July	13	21	22	45	18	34	17	25	18	30
August	13	21	22	45	18	35	17	25	18	30
September	13	21	22	45	18	35	17	25	18	30
October	12½	21	20	45	18	35	17	25	18	30
November	12½	21	20	40	18	34	20	25	19	22
December	12½	21	20	40	18	34	20	25	19	22

TEA—Continued.

Wholesale prices of tea per pound, by months, on New York market, 1907–1911—Contd.

Date.	Foochow, fair to fine.		Formosa, fine to choice.		Japans, pan fired.		India-orange pekoe.		Ceylon-orange pekoe.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1909.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	12½	21	20	40	18	34	20	25	19	22
February	12½	21	20	40	23	35	20	25	19	22
March	13	27	20	40	19	38	20	26	19	26
April	16	27	25	40	22	38	18	26	20	26
May	14	27	24	40	22	35	18	24	19	28
June	14	27	24	40	21½	35	18	24	19	28
July	14	27	24	40	21½	35	18	24	19	28
August	11½	27	24	40	18	35	18	24	18	28
September	11½	27	24	40	18	34	18	24	18	21
October	12	27	24	40	18	34	18	24	18	21
November	12½	27	24	40	18	35½	18	24	18	24
December	12¾	27	23½	40	19	35½	18	24	18	24
1910.										
January	12¾	27	23½	40	19	35½	18	24	18	24
February	12¼	27	23¼	64½	18	35	18	24	18	24
March	12¼	27	23¼	64½	17½	35	18	26½	18	26
April	12½	22	23½	40	17½	33	18	26½	18	26
May	12	22	23½	40	17½	33	18	26½	18	26
June	12	22	23½	40	17½	33	18	26½	18	26
July	12	22	23½	40	17½	36	18	26½	18	26
August	12	22	23½	40	18	36	18	26½	18	26
September	10¾	22	23	40	18	36	18	26½	18	26
October	11	22	23½	40	20	25	18	26½	18	26
November	10½	22	23½	40	20	25	18	26½	18	26
December	10½	22	23½	40	20	25	18	26½	18	26
1911.										
January	10½	22	23½	40	20	26	18	26½	18	26
February	11½	22	23½	40	19	28	18	26½	18	26
March	11½	22	23½	40	19	20	18	26½	18	26
April	11½	22	23½	40	19	20	18	26½	18	26
May	10	22	23½	45	17	20	18	26½	18	26
June	10	22	25	45	17	18	19	25	20	26
July	10	22	25	45	17	19	19	25	20	26
August	11	22	25	45	19	19	19	25	20	26
September	11½	22¾	24	45½	19	19	19	25	20	26
October	12¼	22¾	24½	39	19	32	19	25	20	26
November	15	22¾	24	39	21	32	19	25	20	26
December	14	22¾	24	39	20	32	19	25	20	26

COFFEE.

Coffee crop of countries named, 1906–1910.

Country.	1906	1907	1908	1909	1910
NORTH AMERICA.					
United States:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Porto Rico [1]	38,757,000	35,256,000	28,490,000	45,210,000	33,937,000
Hawaii [1]	1,230,000	1,442,000	1,963,000	2,702,000	3,452,000
Total [2]	39,987,000	36,698,000	30,453,000	47,912,000	37,389,000
CENTRAL AMERICA.					
Guatemala	90,059,000	89,232,000	82,134,000	[3] 96,989,000	[3] 86,163,000
Costa Rica [3]	30,367,000	38,200,000	19,797,000	26,522,000	27,500,000
Nicaragua	[3] 19,419,000	[4] 20,000,000	[4] 17,900,000	[3] 18,610,000	[3] 22,300,000
Salvador	57,425,000	56,320,000	[1] 58,751,000	[1] 63,330,000	[1] 62,764,000
Honduras [4]	5,000,000	5,000,000	5,000,000	5,500,000	5,000,000
British Honduras [5]	12,000	10,000	10,000	10,000	10,000
Total	202,282,000	208,762,000	183,592,000	210,961,000	203,737,000
Mexico	86,961,000	[4] 45,000,000	[4] 42,000,000	[4] 81,000,000	[4] 70,000,000

[1] Exports, year beginning July 1.
[2] Not including Philippine Islands.
[3] Exports, year ending Dec. 31.
[4] Estimated.
[5] Partial returns.

COFFEE—Continued.

Coffee crop of countries named, 1906-1910—Continued.

Country.	1906	1907	1908	1909	1910
WEST INDIES.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Haiti	[1] 64,562,000	[1] 68,904,000	[1] 63,848,000	[1] 41,343,000	[1] 79,425,000
Santo Domingo [2]	2,917,000	3,411,000	4,081,000	1,542,000	4,550,000
Trinidad [3]	19,000	9,000	4,000	4,000	1,000
Jamaica [3]	6,144,000	10,551,000	7,885,000	8,254,000	9,782,000
Guadeloupe [4]	1,903,000	1,903,000	1,903,000	1,903,000	2,500,000
Cuba	(5)	6,596,000	(5)	(5)	(5)
Leeward Islands (British) [2]	1,000	3,000	5,000	2,000	3,000
Total	75,546,000	91,377,000	77,726,000	53,048,000	96,261,000
Total North America	404,776,000	381,837,000	333,771,000	392,921,000	407,387,000
SOUTH AMERICA.					
Brazil: [2]					
Rio de Janeiro	422,435,000	466,395,000	405,069,000	392,574,000	....
Santos	1,344,765,000	1,517,236,000	1,182,579,000	1,779,523,000	....
Victoria	47,140,000	60,973,000	62,885,000	39,616,000	....
Bahia	29,293,000	27,016,000	21,894,000	19,620,000	....
Other ports	3,725,000	2,511,000	2,001,000	1,578,000	....
Total	1,847,358,000	2,074,131,000	1,674,428,000	2,232,911,000	1,286,217,000
Venezuela [6]	99,201,000	90,190,000	103,454,000	93,987,000	93,916,000
Colombia [4]	92,593,000	92,593,000	92,593,000	92,593,000	92,593,000
Bolivia [4]	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Ecuador [2]	5,835,000	2,520,000	8,315,000	7,550,000	7,550,000
Peru [2]	2,469,000	2,443,000	1,102,000	736,000	736,000
Dutch Guiana	481,000	522,000	1,109,000	552,000	552,000
British Guiana	(7)	(7)	89,000	97,000	108,000
Total South America	2,049,437,000	2,263,899,000	1,882,590,000	2,429,926,000	1,483,172,000
ASIA.					
Dutch East Indies:					
Java [5]	66,853,000	31,044,000	39,349,000	29,954,000	27,617,000
Sumatra [8]	4,085,000	5,719,000	9,586,000	3,291,000	3,000,000
Celebes [4]	2,000,000	2,000,000	2,000,000	1,500,000	1,000,000
Total	72,938,000	38,763,000	50,935,000	34,745,000	31,617,000
Federated Malay States: [2]					
Perak	133,000	26,000	2,000	1,000	(7)
Selangor	3,695,000	2,281,000	2,334,000	1,757,000	1,483,000
Negri Sembilan	522,000	259,000	94,000	43,000	15,000
Total	4,350,000	2,566,000	2,430,000	1,801,000	1,498,000
British India [8]	17,695,000	33,051,000	33,826,000	27,648,000	34,984,000
Ceylon	750,000	420,000	310,000	116,000	93,000
British North Borneo [2]	12,000	3,000	4,000	3,000	1,000
Sarawak [2]	38,000	26,000	22,000	17,000	16,000
Arabia (Aden) [3]	12,714,000	14,377,000	15,670,000	15,276,000	15,374,000
Total Asia	108,497,000	89,206,000	103,197,000	79,606,000	83,583,000
AFRICA.					
Somaliland [7]	330,000	198,000	245,000	399,000	208,000
Southern Nigeria [2]	69,000	39,000	37,000	70,000	47,000
Nyasaland Protectorate	506,000	885,000	1,011,000	774,000	308,000
German East Africa [2]	1,105,000	1,393,000	2,228,000	2,228,000	2,228,000
Somali Coast [2]	5,047,000	7,257,000	5,767,000	5,893,000	5,893,000
Liberia [4]	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Abyssinia [4]	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
Uganda Protectorate [3]	12,000	13,000	22,000	33,000	200,000
Sierra Leone	23,000	16,000	21,000	7,000	23,000
Union of South Africa:					
Natal	31,000	28,000	19,000	4,000	4,000
Seychelles [2]	6,000	7,000	6,000	2,000	2,000
Gold Coast [2]	3,000	1,000	(7)	(7)	(7)
Belgian Kongo [2]	165,000	161,000	91,000	28,000	18,000
Total Africa	19,297,000	21,998,000	21,447,000	21,438,000	20,931,000

[1] Exports, year beginning Oct. 1.
[2] Exports, year ending Dec. 31.
[3] Exports, year ending Mar. 31 of the year following that stated.
[4] Estimated.
[5] No data.
[6] Exports, year beginning July 1.
[7] Less than 1,000 pounds.
[8] Partial returns.

COFFEE—Continued.

Coffee crop of countries named, 1906–1910—Continued.

Country.	1906	1907	1908	1909	1910
OCEANIA.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
New Caledonia [1]	626,000	721,000	783,000	1,017,000	1,017,000
Queensland	107,000	112,000	116,000	89,000	151,000
Papua [1]	48,000	39,000	27,000	13,000	13,000
Total Oceania	781,000	872,000	926,000	1,119,000	1,181,000
Grand total	2,582,788,000	2,757,812,000	2,341,931,000	2,925,010,000	1,996,254,000

[1] Exports, year ending Dec. 31.

Wholesale prices of coffee per pound, by months, on the New York and New Orleans markets, 1907–1911.

Date.	New York.												New Orleans.			
	Rio No. 7.		Santos No. 7.		Mocha.		Padang.		Cucuta, washed.		Mexican Cordoba, washed.		Rio No. 7.		Santos No. 7.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1907.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	6 7/8	7 1/4	6 7/8	7 1/4	15 1/2	18	13	14 1/2	9 1/8	11 3/4	9 1/2	12	7	7 1/4	7 1/8	7 3/8
February	6 7/8	7	6 7/8	7	15 1/2	18	13	15	9 1/8	11 3/4	9 1/2	12	7	7 5/8	7 1/4	7 7/16
March	7	7 1/8	7	7 1/8	17	19	13	15	9 1/8	11 3/4	9 1/2	12	7 1/8	7 5/8	7 1/4	7 3/4
April	7	7 1/8	7	7 1/8	17	19	13	15	9 1/4	11 3/4	9 1/2	12	6 5/8	7 1/8	6 5/8	7 1/4
May	6 1/2	7	6 1/2	7	17	19	13	15	9 1/4	11 3/4	9 1/2	12	6 1/2	6 5/8	6 1/2	6 5/8
June	6 1/4	6 1/2	6 1/4	6 1/2	17	19	13	14 1/2	9 1/4	11 3/4	9 1/2	12	6 3/8	6 1/2	6 3/8	6 1/2
July	6 1/4	6 1/2	6 1/4	6 1/2	17	19	13	14 1/2	9 1/4	11 3/4	9 1/2	12	6 3/8	6 5/8	6 3/8	6 5/8
August	6 1/2	6 1/2	6 1/2	6 1/2	17	19	13	19	9 1/4	13 3/4	9 1/2	12	6 1/2	6 3/4	6 5/8	6 7/8
September	6 1/2	6 1/2	6 1/2	6 1/2	17	19	16	19	9 1/4	11 3/4	9 1/2	12	6 1/2	6 5/8	6 5/8	7
October	6 1/2	6 1/2	6 1/2	6 1/2	17	19	16	21	9 1/4	12 1/4	9 1/2	12 1/2	6 3/8	6 5/8	6 7/8	7 1/8
November	6	6 1/2	6	6 1/2	17	19	19	21	10 1/4	12 1/4	10 1/4	12 1/2	6	6 3/8	6 5/8	6 7/8
December	6	6 1/8	6	6 1/8	17	19	19	21	10 1/4	12 1/4	10 1/4	13	6	6 5/16	6 5/8	7
1908.																
January	6	7 1/2	6	7 1/8	17	19	20	21	10 1/4	13 1/2	10 1/2	13	5 3/4	5 7/8	7	7 1/2
February	6 1/4	7 5/8	6 1/4	7 5/8	17	19	19	21	10 1/4	13 1/2	10 1/2	13	5 7/8	6	7 3/8	7 1/2
March	6	7 7/16	6	7 7/16	16 1/2	19	20	21	10	13 1/2	10 1/4	13	5 5/8	6	7	7 1/2
April	6	7 7/8	6	7 7/8	16 1/2	19	19	21	10	13 1/4	10 1/4	12 1/2	5 5/8	5 3/4	7	7 1/8
May	6	7 7/8	6	7 7/8	16 1/2	19	19	20	10	13 1/8	10 1/4	12 1/2	5 3/4	6 1/8	7 1/8	7 5/8
June	6 1/4	7 7/8	6 1/4	7 7/8	14 1/2	19	19	20	10	13 1/8	10 1/4	12 1/2	6	6	7 5/8	7 3/4
July	6 1/4	7	6 1/4	7	14 1/2	17	19	20	10	13 1/8	10 1/4	13	5 7/8	6 1/8	7 1/2	7 3/4
August	6 1/8	7 1/2	6 1/8	7 1/2	15	17	19	20	10 1/2	13 1/8	10 1/2	13	5 7/8	5 7/8	7 1/2	7 1/2
September	6 1/8	7 1/2	6 1/8	7 1/2	15	17	10	20	10 1/4	13 1/8	10 1/2	13	5 7/8	6 1/8	7 1/2	7 1/2
October	6 1/8	7 1/2	6 1/8	7 1/2	15	17	10	20	10 1/4	12 3/4	10 1/2	13	6	6 3/8	7 1/8	7 1/2
November	6 1/4	7 1/2	6 1/4	7 1/2	15	17	10	20	10 1/4	12 3/4	10 1/2	13	6 1/8	6 3/8	7 1/8	7 3/8
December	6 1/2	7 1/4	6 1/2	7 1/4	15	17	10	20	10 1/4	12 3/4	10 1/2	13	6 1/8	6 5/8	7 1/8	7 1/2
1909.																
January	6 1/2	7 5/8	6 1/2	7 5/8	15	17	10	20	10 1/4	14	10 1/2	13	7 1/8	7 1/2	7 1/4	7 1/2
February	7 5/8	8 1/8	7 5/8	8 1/8	15	17	10	20	11 1/2	14	11	13 1/4	7 1/2	8 1/4	8 1/4	8 1/2
March	8 1/4	8 1/4	8 1/8	8 1/4	14 1/2	17	18	20 1/2	11 1/2	14	12	13 1/4	8 1/8	8 3/8	8 1/4	8 5/8
April	8	8 1/2	8	8 1/2	14	17	18	20 1/4	11 1/2	14	10 7/8	13	8 1/8	8 3/8	8 1/8	8 1/2
May	7 7/8	8	8	8	14	16	18	20 1/8	11 1/2	14	10 7/8	12 1/2	8	8 1/4	8 1/4	8 1/4
June	7 3/4	7 7/8	7 7/8	8	14	16	18	20 1/8	11 1/2	14	10 7/8	12 1/2	7 7/8	8	8 1/4	8 3/8
July	7 3/4	7 3/4	7 7/8	8	14	16	16 1/2	20 1/8	10	14	10 1/4	12 1/2	7 3/4	7 7/8	8 1/8	8 1/4
August	7 1/4	7 3/4	7 1/2	8	15	16 1/2	16 1/2	20	9 5/8	13	11	13	7 3/8	7 3/4	8 1/8	8 7/8
September	7 1/4	7 3/8	7 1/2	7 5/8	15	16 1/2	16 1/2	19 1/2	9 5/8	12	11	13 1/4	7 1/4	7 3/8	7 3/4	7 7/8
October	7 1/4	8 1/4	7 1/2	8 1/8	15 1/4	16 1/2	16 3/4	19 1/2	10	12	11 1/4	13 1/4	7 1/4	8 1/4	7 3/4	8 3/8
November	8 1/8	8 5/8	8	8 3/4	14 1/4	16 1/2	16 1/2	20	10	12	11	13 1/4	8 1/4	8 1/2	8 1/4	8 1/2
December	8 1/2	8 5/8	8 1/2	8 5/8	14 1/4	16	16 1/2	20	10	12	10 1/2	13	8 3/8	8 5/8	8 1/2	8 5/8
1910.																
January	8 1/2	8 3/4	8 1/2	8 3/4	14 1/4	16 1/2	17 1/2	20	10	12	10 1/2	12 3/4	8 5/8	8 3/4	8 5/8	8 3/4
February	8 5/8	8 13/16	8 5/8	8 15/16	15	16 1/2	18	20	10 3/4	12	10 1/2	12 3/4	8 5/8	8 3/4	8 3/4	8 7/8
March	8 3/4	8 13/16	8 7/8	8 15/16	14 3/4	16 1/2	17 3/4	20	10 1/2	12	11	12 3/4	8 3/4	8 3/4	8 3/4	9
April	8 7/16	8 13/16	8 1/2	8 15/16	14 3/4	16 1/2	17 1/2	19 1/2	10 1/4	12	11	12 3/4	8 1/2	8 3/4	8 7/8	9
May	8	8 3/8	8 1/2	8 7/8	14 3/4	16 1/2	16 1/2	19 3/4	10 1/4	12	11	12 3/4	8 1/4	8 1/2	9	9
June	8	8 3/8	8 3/4	9	14 3/4	16 1/2	17	19 3/4	10	12	11	12 3/4	8 1/4	8 5/16	9	9

COFFEE—Continued.

Wholesale prices of coffee per pound, by months, on the New York and New Orleans markets, 1907–1911—Continued.

Date.	New York.												New Orleans.			
	Rio No. 7.		Santos No. 7.		Mocha.		Padang.		Cucuta, washed.		Mexican Cordoba, washed.		Rio No. 7.		Santos No. 7.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1910.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
July	8¼	8 9/16	8¾	9⅛	14¾	16½	17	19¾	10	12	11	12¾	8⅜	8 7/16	9	9
August	8⅝	10⅛	9	10¼	14¾	16½	17	19½	10⅜	12½	11	13	8⅝	10	9⅛	10¼
September	10	11	10¼	11¼	14¾	16¾	17½	19¾	11	14	11¼	14	10	11⅛	10¼	11½
October	10⅞	11	11⅛	11⅜	15	17	17½	20	13	14⅞	12¾	14	11	11⅛	11⅛	11½
November	10⅞	13⅛	11⅜	13⅜	15½	17⅛	17½	20	13⅛	16⅛	13	15⅜	11	13¼	11⅛	13⅝
December	13	13½	13⅛	13⅝	15	17⅛	18	20	14¾	15¾	14⅝	15½	13¼	13½	13¼	13⅝
1911.																
January	12⅞	13¾	13⅜	14	15¾	16¾	18½	20	14¾	15¾	14¾	16	13¼	13¾	13½	13⅞
February	12⅛	13	13⅜	13⅝	15¾	16¾	18¾	19¾	14¼	15¾	14¾	16	12⅝	13¼	13	13½
March	12⅛	12⅝	12¾	13½	15¾	16¾	18¾	19¾	13¾	14¾	14½	15¾	12¼	13	12¾	13⅜
April	11¾	12¼	12⅛	12¾	15¾	16¾	18¾	19¾	14	14¾	14½	15	12⅛	12¾	12⅛	12¾
May	11¾	12⅛	12⅛	12⅜	15¾	17¼	18¾	19¾	13¾	14¾	14½	15	11⅜	12¼	12¼	12½
June	12¼	13	12⅜	13	16¾	17¼	18¾	19¾	13¾	14⅝	14½	15⅜	12¼	13⅛	12¼	13¼
July	13⅛	13½	13	13½	16¾	17¼	18¾	19¾	14⅝	15¾	15⅛	15¾	13⅜	13½	13⅜	13⅝
August	13	13⅜	13⅜	13½	16¾	17¼	18¾	19¾	14⅞	15⅞	15¼	15⅞	13⅛	13⅜	13⅜	13⅝
September	13⅜	14	13½	14¼	16¾	18	18¾	21½	14⅝	16¼	15¼	16½	13⅜	14	13⅝	14⅝
October	14	16⅛	14¼	16½	16¾	20	19	22	14⅝	18	16	18¾	14¼	16⅛	14⅝	16½
November	14⅞	15⅞	15½	16¼	18½	20	20	22	16½	18	17⅜	18	14⅞	16	15⅜	16⅜
December	14½	15⅛	14¾	16	18½	19½	20	21	15½	18	17⅜	18	14¼	14⅞	14¾	15½

International trade in coffee, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Brazil	Jan. 1	1,847,367,771	2,074,171,256	1,674,432,552	2,232,926,401	1,286,217,168
British India	Jan. 1	36,584,688	17,866,128	37,568,832	23,625,504	33,669,776
Colombia [2]	Jan. 1	70,000,000	70,000,000	70,000,000	70,000,000	70,000,000
Costa Rica	Jan. 1	30,367,032	38,199,587	19,797,312	26,521,567	27,500,180
Dutch East Indies	Jan. 1	75,761,218	55,998,249	56,806,209	44,346,964	[3] 38,129,646
Guatemala	Jan. 1	69,289,369	99,740,180	63,330,960	96,988,570	[3] 86,000,000
Haiti	Oct. 1	64,561,503	68,903,525	64,000,000	41,000,000	[3] 79,000,000
Jamaica	Apr. 1	6,144,432	10,551,184	7,885,248	8,253,616	9,782,416
Mexico	Jan. 1	37,568,983	29,980,000	52,591,066	54,874,939	48,265,376
Netherlands	Jan. 1	161,617,580	177,012,048	179,444,917	193,098,597	173,823,451
Nicaragua	Jan. 1	19,418,928	[3] 20,000,000	[3] 17,900,000	18,609,741	[3] 22,300,000
Salvador	July 1	68,952,128	58,751,356	57,589,360	63,330,000	[3] 62,764,000
Singapore	Jan. 1	7,860,533	6,314,400	6,765,200	5,488,267	[4] 5,488,267
United States	Jan. 1	32,821,342	41,802,527	34,268,012	35,089,526	47,159,055
Venezuela	Jan. 1	97,907,415	96,279,734	89,557,213	103,256,068	96,655,341
Other countries		60,085,421	74,064,719	88,849,000	71,970,000	[3] 77,010,198
Total		2,686,308,348	2,939,634,893	2,520,785,881	3,089,379,760	2,163,764,874

[1] See "General note," p. 526.
[2] Estimated.
[3] Preliminary.
[4] Year preceding.

COFFEE—Continued.

International trade in coffee, 1906–1910—Continued.

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	20,229,490	21,625,655	22,085,972	25,548,267	26,931,182
Austria-Hungary	Jan. 1	112,841,372	131,930,753	121,780,012	126,991,574	131,835,741
Belgium	Jan. 1	119,040,964	250,282,012	134,658,074	126,319,127	110,565,924
British South Africa	Jan. 1	26,862,060	23,686,674	25,321,709	27,727,936	26,629,533
Cuba	Jan. 1	21,357,127	23,250,910	24,432,111	25,407,861	26,598,543
Denmark	Jan. 1	27,425,498	28,142,000	29,073,012	33,020,499	32,554,446
Egypt	Jan. 1	18,401,914	14,976,566	21,146,287	18,994,922	14,379,781
Finland	Jan. 1	29,085,091	29,007,779	28,549,443	30,191,968	27,970,382
France	Jan. 1	215,713,162	223,932,282	226,559,741	237,975,547	246,488,169
Germany [1]	Jan. 1	411,815,012	418,373,762	425,332,652	470,923,724	376,867,993
Italy	Jan. 1	45,046,159	47,356,824	50,189,763	53,121,381	55,762,491
Netherlands	Jan. 1	255,731,280	259,830,047	262,479,471	288,284,852	264,745,621
Norway	Jan. 1	28,250,644	28,838,572	27,186,340	31,675,494	29,338,865
Russia	Jan. 1	23,584,331	25,067,520	25,691,765	25,757,852	[2] 25,531,750
Singapore	Jan. 1	8,524,000	7,397,600	7,405,067	6,632,133	[3] 6,632,133
Spain	Jan. 1	28,518,089	24,895,066	27,373,358	27,070,627	28,311,268
Sweden	Jan. 1	77,507,951	71,240,034	66,899,643	92,267,883	65,164,883
Switzerland	Jan. 1	24,885,994	25,202,136	24,436,471	26,515,606	25,512,293
United Kingdom	Jan. 1	28,640,738	29,242,982	29,195,788	29,591,296	29,195,770
United States	Jan. 1	857,013,585	940,247,312	938,559,889	1,139,826,171	804,417,451
Other countries		78,324,516	95,070,607	98,942,000	105,957,000	[2] 108,376,000
Total		2,458,798,977	2,719,597,093	2,617,298,568	2,949,801,720	2,463,810,219

[1] Not including free ports prior to Mar. 1, 1906. [2] Preliminary. [3] Year preceding.

OIL CAKE AND OIL-CAKE MEAL.

International trade in oil cake and oil-cake meal, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	29,524,298	26,703,310	31,866,797	36,750,682	46,549,856
Austria-Hungary	Jan. 1	78,843,897	93,136,461	113,952,281	115,295,289	111,420,043
Belgium	Jan. 1	176,470,002	146,626,113	149,098,934	153,062,212	166,846,826
British India	Jan. 1	105,207,200	127,575,168	158,531,296	164,075,296	143,717,056
Canada	Jan. 1	34,803,800	44,286,700	41,743,700	42,774,000	42,246,700
China	Jan. 1	120,944,400	132,974,800	129,166,933	140,888,933	161,685,333
Denmark	Jan. 1	3,101,969	4,889,005	2,757,541	9,378,148	27,472,843
Egypt	Jan. 1	164,142,926	145,538,121	148,649,000	166,676,578	136,751,338
France	Jan. 1	323,482,202	312,335,633	329,693,063	410,340,434	471,357,589
Germany [2]	Jan. 1	361,592,621	396,195,045	414,855,627	431,040,085	450,594,667
Italy	Jan. 1	12,617,052	16,901,514	47,744,617	51,145,397	33,395,942
Netherlands	Jan. 1	147,620,993	206,333,847	156,919,410	158,760,889	247,885,063
Russia	Jan. 1	1,155,869,540	1,164,122,145	1,460,057,008	1,373,467,577	[3] 1,270,123,289
United Kingdom	Jan. 1	58,524,480	49,669,760	36,910,720	247,452,800	392,945,280
United States	Jan. 1	1,929,901,354	1,959,101,228	1,959,213,339	1,488,233,547	1,461,560,725
Other countries		124,546,370	128,143,233	128,897,000	125,812,000	[3] 148,322,000
Total		4,827,193,104	4,954,532,083	5,310,057,266	5,115,153,867	5,312,874,550

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Austria-Hungary	Jan. 1	24,769,590	36,386,625	27,152,565	37,056,460	29,300,457
Belgium	Jan. 1	510,213,668	423,941,798	553,066,958	534,676,433	552,282,540
Canada	Jan. 1	1,889,700	4,290,000	3,741,000	5,024,100	5,391,500
Denmark	Jan. 1	843,140,047	947,748,259	1,036,950,572	1,046,131,201	913,678,392
Dutch East Indies	Jan. 1	26,850,775	21,089,491	14,133,754	7,226,002	[4] 7,226,002
Finland	Jan. 1	14,543,404	23,857,077	20,873,178	22,013,822	21,457,187
France	Jan. 1	237,725,713	247,780,333	200,278,445	273,874,372	290,601,995
Germany [2]	Jan. 1	1,325,622,674	1,573,607,155	1,463,999,742	1,612,275,568	1,573,936,030
Italy	Jan. 1	7,851,541	10,577,997	10,834,835	13,299,690	12,429,976
Japan	Jan. 1	134,060,451	162,850,133	139,939,333	125,114,400	158,061,867
Netherlands	Jan. 1	564,097,473	639,972,913	701,182,543	627,553,310	675,617,307
Sweden	Jan. 1	264,890,580	317,805,100	258,508,025	316,504,552	323,490,312
United Kingdom	Jan. 1	797,115,200	731,057,600	736,330,560	730,833,600	700,483,840
Other countries		143,088,371	157,950,252	161,473,000	162,573,000	[3] 174,107,000
Total		4,895,859,187	5,298,914,733	5,328,464,510	5,514,156,510	5,438,064,405

[1] See "General note," p. 526.
[2] Not including free ports prior to Mar. 1, 1906.
[3] Preliminary.
[4] Year preceding.

ROSIN.

International trade in rosin, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	3,154,594	3,019,450	2,631,878	2,292,784	2,031,318
Germany [2]	Jan. 1	46,088,946	55,019,208	60,958,460	48,019,054	55,682,244
Netherlands	Jan. 1	79,550,046	76,673,653	86,768,631	56,629,686	55,813,677
United States	Jan. 1	694,755,320	738,121,720	728,330,680	555,667,000	635,414,920
Other countries		18,210,324	42,505,829	61,197,000	45,838,000	[3] 72,935,000
Total		841,759,230	915,339,860	939,886,649	708,446,524	821,877,159

MPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Argentina	Jan. 1	22,957,066	23,206,173	23,529,126	28,189,541	28,818,108
Australia	Jan. 1	11,566,016	15,618,176	18,015,312	9,041,200	14,525,392
Austria-Hungary	Jan. 1	73,355,049	74,316,926	82,325,113	70,230,179	70,959,019
Brazil	Jan. 1	21,608,739	26,829,551	34,134,001	33,919,843	[4] 33,919,843
Canada	Jan. 1	19,167,200	21,856,300	17,004,000	22,967,200	23,922,600
Chile	Jan. 1	3,536,588	3,173,882	2,112,888	3,413,356	1,680,783
Cuba	Jan. 1	1,536,070	3,709,909	2,520,339	2,848,506	3,199,188
Denmark	Jan. 1	2,326,979	2,439,414	2,382,094	3,044,553	3,124,359
Finland	Jan. 1	3,893,252	7,509,485	7,058,536	4,370,282	5,273,057
Germany [2]	Jan. 1	235,300,629	247,632,623	286,217,917	216,806,316	240,231,735
Italy	Jan. 1	32,796,618	33,591,825	38,811,048	23,571,583	32,847,217
Japan	Jan. 1	6,599,144	7,120,409	8,035,293	4,738,545	8,151,959
Netherlands	Jan. 1	80,488,983	90,920,593	98,809,593	63,619,681	64,646,156
Russia	Jan. 1	60,581,028	67,762,383	75,526,599	56,329,359	[3] 61,482,042
Servia	Jan. 1	1,371,797	4,562,763	473,546	3,643,860	[4] 3,643,860
Spain	Jan. 1	4,696,182	5,633,969	2,907,176	3,218,374	2,535,581
Sweden	Jan. 1	[5] 593,394	593,394	1,077,928	1,236,139	2,340,253
Switzerland	Jan. 1	5,306,746	5,271,031	4,626,620	4,469,386	4,866,214
United Kingdom	Jan. 1	174,996,752	177,534,336	171,698,688	148,453,648	159,296,032
Uruguay	July 1	6,759,371	533,185	5,836,785	[6] 5,836,785	[6] 5,836,785
Other countries		27,285,931	22,195,464	25,079,000	36,140,000	[3] 36,396,000
Total		796,723,534	842,011,791	908,181,602	746,088,336	807,696,183

[1] See "General note," p. 526.
[2] Not including free ports prior to Mar. 1, 1906.
[3] Preliminary.
[4] Year preceding.
[5] Data for 1907.
[6] Data for 1908.

TURPENTINE.

International trade in spirits of turpentine, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
France	Jan. 1	3,367,371	2,538,714	2,397,710	2,400,228	3,354,146
Germany [2]	Jan. 1	460,735	349,555	433,239	380,385	429,499
Netherlands	Jan. 1	1,740,939	2,034,065	2,345,517	2,068,870	1,812,021
Russia	Jan. 1	1,804,858	1,831,320	1,773,655	1,833,377	[3] 2,382,442
United States	Jan. 1	16,182,500	17,176,843	19,433,181	16,061,783	14,252,321
Other countries		105,869	1,002,284	1,357,000	1,594,000	[3] 1,746,000
Total		23,662,272	24,932,781	27,740,302	24,338,643	23,976,429

[1] See "General note," p. 526. [2] Not including free ports prior to Mar. 1, 1906. [3] Preliminary.

TURPENTINE—Continued.

International trade in spirits of turpentine, 1906–1910—Continued.

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
Argentina	Jan. 1	570,426	521,857	446,967	411,290	433,283
Australia	Jan. 1	377,650	522,656	395,430	347,110	406,402
Austria-Hungary	Jan. 1	2,218,095	2,291,153	2,409,713	2,439,635	2,502,527
Canada	Jan. 1	842,525	1,028,936	1,081,181	1,141,238	1,044,734
Chile	Jan. 1	173,918	207,237	118,542	155,340	168,781
Germany [1]	Jan. 1	9,966,790	8,986,101	10,088,871	9,764,051	8,659,883
Italy	Jan. 1	948,171	921,287	1,020,128	824,643	855,538
Netherlands	Jan. 1	2,807,800	3,207,824	3,985,674	2,785,377	2,696,243
New Zealand	Jan. 1	158,399	145,808	138,807	96,208	[2] 96,208
Russia	Jan. 1	314,342	333,482	238,671	205,106	[3] 230,721
Sweden	Jan. 1	141,077	146,202	148,913	126,289	121,837
Switzerland	Jan. 1	462,297	404,824	503,879	412,046	418,690
United Kingdom	Jan. 1	7,673,758	7,515,293	8,656,464	6,522,833	7,041,316
Other countries		1,884,017	982,536	956,000	725,000	[3] 928,000
Total		28,539,265	27,215,196	30,189,240	25,956,166	25,604,163

[1] Not including free ports prior to Mar. 1, 1906. [2] Year preceding. [3] Preliminary.

INDIA RUBBER.

International trade in india rubber, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Angola	Jan. 1	[2] 5,200,000	[2] 5,200,000	[2] 5,200,000	[2] 5,200,000	[2] 5,200,000
Belgian Kongo	Jan. 1	10,690,060	10,266,314	10,052,913	8,268,606	7,532,598
Belgium	Jan. 1	16,940,908	13,886,021	15,036,638	16,168,832	18,303,063
Bolivia	Jan. 1	4,254,058	4,035,589	4,008,415	6,729,438	6,629,922
Brazil	Jan. 1	77,073,991	80,446,154	84,230,498	86,038,347	84,980,716
Dutch East Indies	Jan. 1	4,564,932	14,068,081	6,719,897	3,587,702	[3] 3,366,847
Ecuador	Jan. 1	1,394,575	1,033,670	887,085	1,120,234	[4] 1,120,234
France	Jan. 1	13,033,578	12,751,379	13,045,487	15,993,271	26,935,141
French Guinea	Jan. 1	3,374,026	2,864,282	2,878,698	3,990,260	[4] 3,990,260
French Kongo	Jan. 1	4,310,082	4,061,352	3,378,585	3,827,832	[4] 3,827,832
Germany [5]	Jan. 1	19,887,013	10,500,394	9,099,798	8,964,345	10,481,330
Gold Coast	Jan. 1	3,649,668	3,549,548	1,773,248	2,764,190	3,223,265
Ivory Coast	Jan. 1	3,347,895	3,024,783	2,018,644	2,737,842	3,088,645
Kamerun	Jan. 1	2,537,540	3,291,084	5,289,408	3,345,778	4,324,887
Netherlands	Jan. 1	5,605,388	4,121,106	3,774,042	3,952,718	3,805,062
Peru	Jan. 1	5,678,357	6,675,430	5,546,104	294,998	[4] 294,998
Senegal	Jan. 1	2,618,511	2,293,164	1,279,587	2,258,273	1,526,624
Singapore	Jan. 1	5,888,000	5,422,133	4,875,067	5,544,267	[4] 5,544,267
Southern Nigeria	Jan. 1	3,434,279	2,843,823	1,222,203	1,388,009	2,634,023
Venezuela	Jan. 1	381,426	626,265	627,407	463,178	856,652
Other countries		18,266,180	25,194,477	24,085,000	33,384,000	[3] 47,887,000
Total		212,130,467	216,155,049	205,028,724	216,022,120	245,553,366

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Austria-Hungary	Jan. 1	4,231,331	4,967,454	4,237,504	4,744,740	6,156,346
Belgium	Jan. 1	20,813,089	18,292,494	17,783,480	18,854,099	23,316,174
Canada	Jan. 1	2,542,580	2,777,668	1,868,569	2,759,751	2,967,430
France	Jan. 1	23,053,199	24,111,907	22,097,539	25,579,092	37,148,833
Germany [5]	Jan. 1	51,488,947	34,851,767	32,498,112	34,208,999	41,237,704
Italy	Jan. 1	2,586,242	2,241,660	3,298,996	3,455,490	4,142,002
Netherlands	Jan. 1	8,189,950	8,142,875	6,522,685	6,364,301	7,885,995
Russia	Jan. 1	16,702,892	15,036,756	16,683,536	15,826,110	[3] 16,214,647
United Kingdom	Jan. 1	31,004,400	35,646,016	24,253,600	33,839,456	45,818,864
United States	Jan. 1	67,907,251	68,653,291	76,289,474	93,967,414	90,139,232
Other countries		11,639,538	11,271,855	11,082,000	11,637,000	[3] 12,364,000
Total		240,159,419	225,993,743	216,615,495	251,236,452	287,391,227

[1] See "General note," p. 526.
[2] Estimated.
[3] Preliminary.
[4] Year preceding.
[5] Not including free ports prior to Mar. 1, 1906.

SILK.

Production of raw silk in countries named, 1906–1910.

[Estimate of the Silk Manufacturers' Association of Lyons, France.]

Country.	1906	1907	1908	1909	1910[1]
Western Europe:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Italy	10,461,000	10,626,000	9,890,000	1,486,000	701,000
France	1,333,000	1,459,000	1,446,000	9,372,000	8,702,000
Spain	124,000	181,000	165,000	181,000	183,000
Austria-Hungary	754,000	761,000	736,000	833,000	776,000
Total	12,672,000	13,027,000	12,237,000	11,872,000	10,362,000
Levant and Central Asia:					
Anatolia	1,221,000	1,327,000	1,356,000	1,466,000	1,058,000
Syria and Cyprus	1,037,000	1,179,000	1,080,000	981,000	1,190,000
Other provinces of Asiatic Turkey	....	322,000	320,000	276,000	287,000
Salonica and Adrianople	567,000	754,000	628,000	838,000	794,000
Balkan States	408,000	496,000	456,000	492,000	386,000
Greece and Crete	165,000	168,000	143,000	132,000	126,000
Caucasus	1,003,000	1,085,000	794,000	1,190,000	1,146,000
Persia and Turkestan (exports)	1,385,000	1,340,000	1,160,000	1,323,000	1,186,000
Total	5,786,000	6,671,000	5,937,000	6,698,000	6,173,000
Far East:					
China—					
Exports from Shanghai	9,396,000	9,160,000	12,430,000	11,431,000	11,448,000
Exports from Canton	4,325,000	4,960,000	5,243,000	5,059,000	5,814,000
Japan—					
Exports from Yokohama	13,210,000	14,044,000	16,689,000	18,457,000	19,698,000
British India—					
Exports from Calcutta and Bombay	717,000	772,000	551,000	518,000	507,000
Total	27,648,000	28,936,000	34,913,000	35,465,000	37,467,000
Grand total	46,106,000	48,634,000	53,087,000	54,035,000	54,002,000

[1] Preliminary.

WOOD PULP.

International trade in wood pulp, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	176,917,829	187,836,660	177,784,025	173,668,467	194,807,715
Belgium	Jan. 1	68,233,066	72,943,332	54,463,780	59,705,365	82,609,340
Canada	Jan. 1	[2] 397,000,000	[2] 483,000,000	[2] 480,000,000	561,487,800	657,955,900
Finland	Jan. 1	123,858,426	133,410,176	140,860,769	157,561,012	191,271,652
Germany[3]	Jan. 1	156,740,026	211,885,779	281,362,458	341,335,793	388,760,487
Norway	Jan. 1	1,114,716,540	1,227,103,672	1,310,902,325	1,326,893,206	1,401,685,165
Sweden	Jan. 1	914,501,238	1,170,316,873	1,242,850,222	1,242,456,239	1,682,832,631
Switzerland	Jan. 1	13,901,905	13,066,133	12,338,167	11,168,724	13,013,313
United States	Jan. 1	28,267,309	24,839,012	22,595,379	17,905,481	16,721,779
Other countries	....	79,751,207	75,160,286	56,826,000	74,190,000	[4] 70,249,000
Total	....	3,073,887,546	3,599,561,923	3,779,983,125	3,966,372,087	4,699,906,982

[1] See "General note," p. 526.
[2] Estimated from value.
[3] Not including free ports prior to Mar. 1, 1906.
[4] Preliminary.

WOOD PULP—Continued.

International trade in wood pulp, 1906-1910—Continued.

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	37,368,826	40,845,920	39,930,837	33,847,259	58,283,142
Austria-Hungary	Jan. 1	4,050,552	4,304,084	5,601,724	7,675,094	11,400,428
Belgium	Jan. 1	228,929,053	243,156,228	265,428,111	258,171,760	282,016,826
Denmark	Jan. 1	64,300,231	80,113,097	75,010,059	100,035,930	100,798,280
France	Jan. 1	563,826,785	630,970,533	692,701,492	640,890,227	789,105,044
Germany [1]	Jan. 1	103,547,347	116,995,542	99,261,783	90,295,125	88,516,233
Italy	Jan. 1	114,677,382	126,906,861	135,943,606	145,528,953	158,366,559
Japan	Jan. 1	37,020,666	35,476,759	40,753,602	38,311,700	79,726,177
Russia	Jan. 1	46,715,121	45,479,955	49,052,161	49,932,916	[2] 52,829,415
Spain	Jan. 1	76,781,583	82,575,953	79,954,210	69,243,596	70,047,697
Sweden	Jan. 1	7,882,006	6,691,936	6,448,409	6,685,152	8,205,120
Switzerland	Jan. 1	16,764,828	19,232,681	20,914,147	19,705,376	17,125,553
United Kingdom	Jan. 1	1,341,735,360	1,484,703,360	1,662,662,400	1,661,959,040	1,892,571,520
United States	Jan. 1	399,403,200	593,555,200	500,969,689	735,300,119	1,013,550,715
Other countries		118,569,048	25,424,495	25,366,000	59,225,000	[2] 78,477,000
Total		3,161,571,988	3,536,432,604	3,699,998,230	3,916,807,247	4,701,019,709

[1] Not including free ports prior to Mar. 1, 1906. [2] Preliminary.

FARM ANIMALS AND THEIR PRODUCTS.

Live stock of countries named.

[Africa incompletely represented, through lack of statistics for large areas. Number of animals in China, Persia, Afghanistan, Korea, Bolivia, Ecuador, and several less important countries unknown. For Brazil number of cattle alone estimated, but roughly. In general, statistics of cattle, horses, sheep, and swine much more complete than those of other animals, as statements for the world.]

Country.	Year.	Cattle.		Horses.	Mules.	Sheep.	Swine
		Total.	Dairy cows.				
NORTH AMERICA.							
United States:							
Contiguous—		*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
On farms	1912	57,959,000	20,699,000	20,509,000	4,362,000	52,362,000	65,410,000
Not on farms	1910	1,878,782	1,170,338	3,182,789	270,371	390,887	1,287,960
Noncontiguous—							
Alaska [1]	1910	1,167	459	2,312	214	199	379
Hawaii [1]	1910	148,466	8,140	25,716	9,127	76,719	30,140
Porto Rico	1899	260,225	73,372	58,664	6,985	6,363	66,180
Total United States (except Philippine Islands)	......	60,247,640	21,951,309	23,778,481	4,648,697	52,836,168	66,794,659
Bermuda	1907	1,516	....	[2] 1,082	....	....	....
Canada:							
Prince Edward Island	1911	112,000	55,500	34,000	....	108,600	46,400
Nova Scotia	1911	332,600	151,700	69,000	....	351,000	70,000
New Brunswick	1911	233,800	123,300	66,700	....	190,800	93,000
Quebec	1911	1,482,000	872,800	371,400	....	533,400	697,500
Ontario	1911	2,793,100	1,234,500	791,000	....	975,400	1,469,800
Manitoba	1911	454,500	161,200	251,800	....	29,600	135,800
Saskatchewan	1911	588,300	143,600	365,500	....	111,300	130,300
Alberta	1911	1,090,300	134,000	317,000	....	179,200	149,400
British Columbia	1901	125,002	24,535	37,325	....	33,350	41,419
Total Canada	......	7,211,602	2,901,135	2,303,725	....	2,512,650	2,833,619
Central America:							
Costa Rica	1910	333,017	[3] 125,439	60,114	3,185	604	69,712
Guatemala	1898	196,768	....	50,343	....	77,593	29,784
Honduras	1909	666,215	....	64,122	13,434	24,052	145,352
Nicaragua	1908	252,070	....	28,276	6,078	338	11,591
Panama	1907	65,000	....	17,000	1,500	....	28,000
Salvador	1908	284,013	....	74,336	....	21,457	422,980
Mexico	1902	5,142,457	....	859,217	334,435	3,424,430	616,139
Newfoundland	1901	32,767	....	8,851	....	78,052	34,679
West Indies:							
British—							
Bahamas	1910	1,320	....	1,140	....	9,413	....
Barbados	1910	....	....	2,434	[4] 3,741	....	....
Dominica	1903	1,437	....	[5] 658	....	1,088	....
Grenada	1910	5,109	....	1,493	....	1,975	....
Jamaica	1910	110,506	....	51,905	....	12,359	32,150
Montserrat	1910	....	....	230	....	....	....
Trinidad and Tobago	1910	11,675	....	4,596	....	2,744	9,991
Turks and Caicos Islands	1910	569	....	111	....	101	526
Virgin Islands	1907	2,000	....	[5] 65	....	300	....
Cuba	1910	3,074,509	....	555,423	58,957	[6] 9,982	[6] 358,868
Dutch West Indies	1909	3,799	....	827	175	22,643	5,582
Guadeloupe	([7])	30,560	....	8,819	6,311	11,731	32,656
Total	......	77,674,549	([8])	27,873,248	5,076,513	59,047,680	71,426,288

[1] Preliminary.
[2] Including mules and asses.
[3] Cows.
[4] Data for 1909.
[5] Data for 1910.
[6] Census, 1899.
[7] Official estimates furnished by the French Embassy to the United States under date of May 4, 1906.
[8] Total omitted, because of too few reports for individual countries.

Live stock of countries named—Continued.

Country.	Year.	Cattle.		Horses.	Mules.	Sheep.	Swine.
		Total.	Dairy cows.				
SOUTH AMERICA.		*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Argentina	1908	29,116,625		7,531,376	465,037	67,211,754	1,403,591
Brazil		25,000,000					
British Guiana	1910	71,500		2,160		17,500	16,600
Chile	1910	906,915	530,360	347,129	[1] 56,242	3,636,053	177,687
Colombia		2,800,000		341,000	257,000	746,000	2,300,000
Dutch Guiana	1909	6,990		270	257	109	2,726
Falkland Island	1910	5,382		3,314		724,736	72
Paraguay [2]	1908	5,500,000		182,790	7,626	214,060	23,900
Uruguay	1908	8,192,602		556,307	17,671	26,286,296	180,099
Venezuela	1899	2,004,257		191,079	89,186	176,668	1,618,214
Total		73,604,271	([3])	9,155,425	893,019	99,013,176	5,722,889
EUROPE.							
Austria-Hungary:							
Austria	1911	9,159,808		1,801,090	73,041	2,428,586	6,431,966
Hungary	1909	7,152,568		2,173,648	[4] 1,911	7,904,634	5,489,946
Bosnia-Herzegovina	1910	1,308,753		221,896	475	2,498,854	527,223
Total Austria-Hungary		17,621,129		4,196,634	75,427	12,832,074	12,449,135
Belgium	[5] 1910	1,865,833	[6] 920,534	255,229	[4, 7] 6,915	[4] 235,722	1,116,500
Bulgaria	1906	1,695,533	[8] 493,451	538,271	11,947	8,130,997	465,333
Denmark	1909	2,253,982	[8] 1,281,974	535,018		726,879	1,467,822
Faroe Islands	1909	4,093		615		99,900	58
Finland	1907	1,491,264	[8] 1,113,633	327,817		904,447	221,072
France	[5] 1910	14,532,030	[8] 7,596,250	3,197,720	192,740	17,110,760	6,900,230
Germany	1907	20,630,544	10,222,792	4,345,047	942	7,703,710	22,146,532
Gibraltar	1910	405		288			
Greece	1902	406,744		159,068	88,869	4,568,158	79,716
Iceland	1908	23,413		45,121		512,418	
Italy	1908	6,198,861		955,878	388,337	11,162,926	2,507,798
Luxemburg	1907	103,485	58,449	18,847		8,467	134,067
Malta	1911	6,863		[9] 3,384	[9] 3,053	17,653	4,659
Montenegro		60,000	20,000	3,000		400,000	8,000
Netherlands	1910	2,026,943	[10] 1,068,361	327,377		889,036	1,259,844
Norway	[5] 1908	1,094,101	[8] 727,898	172,468		1,393,488	318,556
Portugal	1906	703,198		87,765	57,647	3,072,988	1,110,957
Roumania	1900	2,545,051	380,720	864,324	515	5,655,444	1,709,205
Russia:							
Russia proper	1909	30,735,000		20,961,000		[11] 40,149,000	9,743,000
Poland	1909	2,268,000		1,243,000		[11] 1,248,000	608,000
Northern Caucasia	1909	2,778,000		1,344,000		[11] 5,592,000	684,000
Total European Russia	1909	35,781,000		23,548,000		46,989,000	11,035,000
Servia	1905	969,953		174,363	739	3,160,166	908,108
Spain	1911	2,368,767		519,665	886,113	15,117,105	2,424,039
Sweden	1909	2,685,020	[8] 1,838,770	574,872		1,010,217	894,670
Switzerland	1911	1,443,371		143,723		159,727	569,253
Turkey, European [12]	1908	1,471,801		254,964	65,381	6,912,568	203,633

[1] Including asses.
[2] Unofficial estimate.
[3] Total omitted, because of too few reports for individual countries.
[4] Data for 1895.
[5] On December 31 of preceding year.
[6] Dairy cows 2 years and over.
[7] On farms.
[8] Cows.
[9] Data for 1910.
[10] Including cows kept for breeding purposes.
[11] Including goats.
[12] Not including vilayets of Scutari and Constantinople.

Live stock of countries named—Continued.

Country.	Year.	Cattle. Total.	Cattle. Dairy cows.	Horses.	Mules.	Sheep.	Swine.
EUROPE—continued.							
United Kingdom:		*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Great Britain	1911	7,114,264	[1] 2,825,049	[2] 1,627,393	....	26,494,992	2,822,154
Ireland	1911	4,711,720	[1] 1,565,418	[2] 616,331	31,740	3,907,436	1,415,119
Isle of Man and Channel Islands	1910	39,238	[1] 16,984	[2] 9,694	....	82,126	11,530
Total United Kingdom	......	11,865,222	4,407,451	2,253,418	31,740	30,484,554	4,248,803
Total	......	129,848,606	([3])	43,502,876	1,810,365	179,258,404	72,182,990
ASIA.							
British India:							
British Provinces	1910	[4] 103,204,451	31,779,835	1,554,419	[5] 113,643	23,237,546	....
Native States [6]	1909	[4] 9,869,221	3,349,621	129,190	....	3,321,366	....
Total British India	......	113,073,672	35,129,456	1,683,609	113,643	26,558,912	....
Ceylon	1909	1,509,554	....	4,042	....	96,335	97,148
Cochin China	1903	109,000	....	11,243	....	....	709,400
Cyprus	1911	62,091	....	[7] 68,740	....	[8] 294,456	35,181
Formosa	[9] 1900	[10] 163,991	....	153	....	....	1,268,256
Hongkong	1910	1,802	....	209	....	1	....
Japan	[9] 1910	1,350,404	....	1,551,156	....	3,411	287,107
Dutch East Indies:							
Java and Madura	1905	2,654,461	....	363,974	....	....	....
Other	1905	449,268	....	118,645	....	....	....
Total Dutch East Indies	1905	3,103,729	....	482,619	....	....	....
Philippine Islands [11]	1911	242,398	....	215,674	....	88,760	2,066,605
Russia—							
Central Asia	1909	4,545,000	....	3,985,000	....	[12] 21,456,000	123,000
Siberia	1909	5,184,000	....	4,179,000	....	[12] 5,439,000	1,191,000
Transcaucasia	1909	2,981,000	....	402,000	....	5,679,000	302,000
Other	1903	2,343,000	....	1,624,000	....	5,443,000	186,400
Total Asiatic Russia	......	15,053,000	....	10,190,000	....	38,017,000	1,802,400
Siam	1904	2,209,522	....	71,624	....	....	....
Straits Settlements and Labuan	1910	43,805	....	3,170	....	....	137,894
Turkey, Asiatic	......	3,000,000	....	800,000	....	45,000,000	....
Total	......	139,922,968	([3])	15,082,239	113,643	110,058,875	6,403,991
AFRICA.							
Algeria	1909	1,100,586	421,537	233,243	[13] 187,714	9,066,916	110,700
Basutoland	1904	213,361	....	64,621	[14] 26	[14] 2,794	[14] 476
Bechuanaland	1910	323,911	....	1,632	....	358,366	....
British East Africa	1910	750,000	....	850	....	6,000,000	3,000
Egypt	1909	725,116	....	[15] 54,666	[16] 10,000	....	....
Eritrea	1905	250,891	....	[7] 29,789	....	[12] 736,132	....
Gambia	1907	82,871	....	3,851	....	....	....
German East Africa	1905	523,052	....	73	79	1,560,000	1,447
German Southwest Africa	1909	96,112	....	8,271	4,636	300,722	2,917

[1] Cows and heifers in milk and with calf.
[2] Used for agriculture and unbroken.
[3] Total omitted, because of too few reports for individual countries.
[4] Including buffalo calves.
[5] Of which 31,936 in Bengal includes donkeys.
[6] Data only for those States for which official figures are available.
[7] Including mules and asses.
[8] Not less than 1 year old; 30 per cent may be added for those less than 1 year old.
[9] On Dec. 31 of preceding year.
[10] Including 162,985 Zebu cattle and 1,006 imported and cross breeds.
[11] 10 per cent may be added to cover incompleteness of returns.
[12] Including goats.
[13] Data for 1908.
[14] Excluding animals owned by natives.
[15] Data for 1907.
[16] Data for 1900.

Live stock of countries named—Continued.

Country.	Year.	Country.		Horses.	Mules.	Sheep.	Swine.
		Total.	Dairy cows.				
AFRICA—continued.		*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Madagascar	1905	2,867,612	[11]1,118,162	1,074	464	333,454	522,021
Mauritius	1910	[2]16,392		1,483		1,089	3,787
Mayotte	(3)	47,894		21	15	124	
Nyasaland Protectorate	1911	54,994		[4]252		14,763	10,958
Reunion		4,720		1,780	4,534	4,583	
Rhodesia:							
Northeastern	1909	20,500					
Northwestern	1909	18,000		[5]1,661		[6]14,000	
Southern	1910	371,000				231,736	
St. Helena	1910	1,271		152		4,446	282
Seychelles	1910	1,000		150		200	5,000
Sierra Leone	1910	1,687		6		674	10
Southern Nigeria (Lagos)	1902	1,522		108		1,610	2,426
Sudan (Anglo-Egyptian)[7]	1908	340,372		8,251		952,950	
Swaziland	1910	50,000		[8]600		10,000	
Tunis	1911	170,831		36,965	19,603	615,584	8,003
Uganda Protectorate	[9]1909	468,027		28		471,297	600
Union of South Africa:							
Cape of Good Hope	1904	1,954,390	540,310	255,060	64,433	[10]19,026,884	385,945
Natal	1909	502,212		58,186	7,032	1,068,996	77,238
Orange River Colony	1909	721,258		132,574	[11]4,674	7,481,251	52,983
Transvaal	1910	989,018		140,617	15,158	3,170,708	172,031
Total Union of South Africa		4,166,878	(12)	586,437	91,297	30,747,839	688,197
Total		12,668,600	(12)	1,035,964	318,368	51,429,279	1,359,824
OCEANIA.							
Australia:							
Queensland	[13]1910	5,131,699		593,813		20,331,838	152,212
New South Wales	[13]1910	3,141,870		650,618		45,632,263	321,524
Victoria	[13]1910	1,572,569		469,729		13,098,665	294,654
South Australia	[13]1910	898,245		273,835		6,324,717	97,382
Western Australia	[13]1910	825,029		133,942		5,178,658	57,677
Tasmania	[13]1911	201,854	52,966	41,388		1,788,310	63,715
Total Australia		11,771,266	(12)	2,163,325		92,354,451	987,164
Fiji	1910	40,492		6,338		5,601	[11]3,716
New Caledonia	(3)	73,862		2,938	12	9,442	2,438
New Zealand	1911	2,020,171	633,733	404,284	404	23,996,126	348,754
Territory of Papua	1910	1,123		318		71	[14]198
Total		13,906,914	(12)	2,577,203	416	116,365,691	1,342,270
Grand total		447,625,908	(12)	99,226,955	8,212,324	615,173,105	158,438,252

[1] Data for 1900.
[2] On sugar estates only.
[3] Official estimate furnished by the French Embassy to the United States under date May 4, 1906.
[4] Including mules and asses.
[5] Number of horses, mules, and asses owned by natives.
[6] Data for 1907.
[7] Animals assessed for tribute and taxes.
[8] Including mules.
[9] Jan. 1.
[10] Census, 1910.
[11] Data for 1908.
[12] Total omitted, because of too few reports for individual countries.
[13] Year ending Mar. 31.
[14] Data for 1909.

Live stock of countries named—Continued.

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
NORTH AMERICA.						
United States:						
Contiguous—		*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
On farms	1910	105,698	....	....	2,915,125	....
Not on farms	1910	16,502	....	....	114,670	....
Noncontiguous—						
Alaska [1]	1910	3	....	....	36	22,106
Hawaii [1]	1910	3,030	400	....	7,558	....
Porto Rico	1899	1,085	....	....	15,991	....
Total United States (except Philippine Islands)	....	126,318	400	....	3,053,380	22,106
Central America:						
Costa Rica	1910	149	....	....	776	....
Honduras	1909	2,373	....	....	....	....
Nicaragua	1908	1,343	....	....	979	....
Panama	1907	47	....	....	3,000	....
Mexico	1902	287,991	....	....	4,206,011	....
Newfoundland	1901	....	....	....	17,355	450
West Indies:						
British—						
Barbados	1909	3,925	....	....	....	....
Jamaica	1909	....	....	....	17,200	....
Trinidad and Tobago	[2] 1909	....	....	....	6,451	....
Cuba	1910	3,340	....	....	[3] 18,564	....
Dutch	1909	6,242	....	....	60,152	....
Guadeloupe	([4])	4,394	....	....	13,902	....
Total	....	436,122	400	....	7,397,770	22,556
SOUTH AMERICA.						
Argentina	1908	285,088	....	....	3,945,086	....
British Guiana	1907	5,750	....	....	13,500	....
Chile	1910	....	....	....	205,080	....
Colombia	....	....	....	....	361,000	....
Dutch Guiana	1909	321	....	....	2,686	....
Paraguay	1908	....	....	....	32,334	....
Uruguay	1908	4,428	....	....	19,951	....
Venezuela	1899	312,810	....	....	1,667,272	....
Total	....	608,397	....	....	6,246,909	....
EUROPE.						
Austria-Hungary:						
Austria	1911	....	....	....	1,253,650	....
Hungary	1909	[5] 23,855	133,000	....	308,997	....
Bosnia-Herzegovina	1910	6,246	979	....	1,392,565	....
Total Austria-Hungary	....	30,101	133,979	....	2,955,212	....
Belgium	[2] 1905	....	....	....	257,669	....
Bulgaria	1906	124,080	476,872	....	1,384,116	....
Denmark	1909	167	....	....	40,257	....
Faroe Islands	1909	....	....	....	13	....
Finland	1907	....	....	....	6,279	133,749
France	[2] 1910	360,710	....	....	1,417,710	....
Germany	1907	10,349	....	....	3,533,970	....
Greece	1902	141,179	....	....	3,339,409	....
Iceland	1908	....	....	....	520	....
Italy	1908	849,723	19,362	....	2,714,878	....
Luxemburg	1907	27	....	....	11,344	....
Malta	1910	3,325	....	....	18,415	....
Montenegro	....	....	....	....	100,000	....
Netherlands	1910	....	....	....	224,231	....
Norway	[2] 1907	....	....	....	296,442	142,623
Portugal	1906	144,089	....	....	1,034,218	....
Roumania	1900	7,186	43,475	....	232,515	....
Russia:						
Russia proper	1905	....	....	224,500	....	347,000
Poland	....	....	....	1,000	....	....
Total European Russia	....	....	....	225,500	....	347,000

[1] Preliminary.
[2] Dec. 31 of preceding year.
[3] Census, 1899.
[4] Official estimate furnished by the French Embassy to the United States under date of May 4, 1906.
[5] Data for 1895.

Live stock of countries named—Continued.

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
EUROPE—continued.		*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Servia	1905	1,247	7,710		510,063	
Spain	1911	867,864			3,216,489	
Sweden	1909				65,887	237,253
Switzerland	1911				339,997	
Turkey, European [1]	1908	224,949	156,858	2,801	3,520,873	
United Kingdom: Ireland	1911	246,353			258,474	
Total		3,011,349	838,256	228,301	25,478,981	860,625
ASIA.						
British India:						
British Provinces	1910	1,337,204	16,985,716	446,700	30,654,171	
Native States [2]	1909	[3] 144,294	1,470,622	53,171	3,285,553	
Total British India		1,481,498	18,456,338	499,871	33,939,724	
Ceylon	1909		[4] 579,069		170,645	
Cochin China	1903		241,750			
Cyprus	1911			1,191	[5] 270,981	
Formosa	[6] 1910		295,474		143,568	
Hongkong	1909				194	
Japan	[6] 1910				87,338	
Dutch East Indies:						
Java and Madura	1905		2,186,993			
Other	1905		446,540			
Total Dutch East Indies			2,633,533			
Philippine Islands [7]	1911		[8] 713,121		407,087	
Russia:						
Central Asia (4 provinces)	1903			365,000		
Siberia (4 provinces)	1903			500		38,700
Transcaucasia	1902	122,312	338,042	17,122	745,086	
Other	1903	58,500		296,000	802,000	20,000
Total, Asiatic Russia		180,812	338,042	678,622	1,547,086	58,700
Siam [9]	1904		2,288,956			
Turkey, Asiatic		2,500,000			9,000,000	
Total		4,162,310	25,546,283	([10])	45,566,623	58,700
AFRICA.						
Algeria	1908	271,794		204,715	[11] 4,006,913	
Basutoland	1904	[12] 10			1,625	
British East Africa	1910				3,688,773	
Egypt	1900	120,000	[11] 728,284	40,000		
Eritrea	1905			46,853		
German East Africa	1905	8,777		24	1,820,000	
German South Africa	1909	5,189		240	242,023	
Madagascar [13]	1905	411			66,747	
Mauritius [13]	1909	[3] 103			6,161	
Mayotte	([14])	58			1,508	
Nyasaland Protectorate	1911				111,973	
Reunion	([14])	1,916			4,156	
Rhodesia	1909				595,000	
St. Helena	1901	774			1,001	
Seychelles	1909				500	
Southern Nigeria Colony (Lagos)	1902	19,289			2,600	
Sudan (Anglo-Egyptian)	1908			123,705	846,544	
Swaziland	1910				80,000	
Tunis	1911	80,060		107,506	332,560	

[1] Does not include vilayets of Scutari and Constantinople.
[2] Data only for those States for which official estimates are available.
[3] Including mules.
[4] Data for 1908.
[5] Not less than 1 year old; 30 per cent may be added for those less than 1 year old.
[6] Dec. 31 of preceding year.
[7] Ten per cent may be added to cover incompleteness of returns.
[8] Carabaos.
[9] Number of domesticated elephants returned as 4,072.
[10] Total omitted, because of too few reports for individual countries
[11] Data for 1909.
[12] Including animals owned by natives.
[13] On sugar estates only.
[14] Official estimate furnished by the French Embassy to the United States under date of May 4, 1906.

Live stock of countries named—Continued.

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
AFRICA—continued.						
Union of South Africa:		*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Cape of Good Hope	1904	100,470			[1] 8,275,120	
Natal	1909	10,330			910,848	
Orange River Colony	1908	5,323			1,251,308	
Transvaal	1909	41,676			1,651,890	
Total Union of South Africa		157,799			12,089,166	
Total		666,180	728,284	(2)	23,897,250	
OCEANIA.						
Australia:						
New South Wales	1905			853	37,716	
South Australia	1905				26,948	
Western Australia	[3] 1910	1,858		3,257	31,988	
Tasmania	1911				2,118	
Total Australia		1,858		4,110	98,770	
Fiji	1909				13,001	
New Caledonia	(4)				6,111	
New Zealand	1891				[5] 9,055	
Territory of Papua	1909				550	
Total		1,858		(2)	127,487	
Grand total		8,886,216	27,113,223	(2)	108,715,020	941,881

[1] Census, 1910.
[2] Total omitted, because of too few reports for individual countries.
[3] December 31 of preceding year.
[4] Official estimate furnished by the French Embassy to the United States under date of May 4, 1906.
[5] Including goats owned by Maoris.

FARM ANIMALS AND THEIR PRODUCTS IN CONTINENTAL UNITED STATES.

HORSES AND MULES.

Number and farm value of horses and mules on farms in the United States, 1867–1912.

January 1—	Horses.			Mules.		
	Number.	Price per head Jan. 1.	Farm value Jan. 1.	Number.	Price per head Jan. 1.	Farm value Jan. 1.
1867	5,401,000	$59.05	$318,924,000	822,000	$66.94	$55,048,000
1868	5,757,000	54.27	312,416,000	856,000	56.04	47,954,000
1869	6,333,000	62,57	396,222,000	922,000	79.23	73,027,000
1870	8,249,000	67.43	556,251,000	1,180,000	90.42	106,654,000
1871	8,702,000	71.14	619,039,000	1,242,000	91.98	114,272,000
1872	8,991,000	67.41	606,111,000	1,276,000	87.14	111,222,000
1873	9,222,000	66.39	612,273,000	1,310,000	85.15	111,546,000
1874	9,334,000	65.15	608,073,000	1,339,000	81.35	108,953,000
1875	9,504,000	61.10	580,708,000	1,394,000	71.89	100,197,000
1876	9,735,000	57.29	557,747,000	1,414,000	66.46	94,001,000
1877	10,155,000	55.83	567,017,000	1,444,000	64.07	92,482,000
1878	10,330,000	56.63	584,999,000	1,638,000	62.03	101,579,000
1879	10,939,000	52.36	572,712,000	1,713,000	56.00	95,942,000
1880	11,202,000	54.75	613,297,000	1,730,000	61.26	105,948,000
1881	11,430,000	58.44	667,954,000	1,721,000	69.79	120,096,000
1882	10,522,000	58.53	615,825,000	1,835,000	71.35	130,945,000
1883	10,838,000	70.59	765,041,000	1,871,000	79.49	148,732,000
1884	11,170,000	74.64	833,734,000	1,914,000	84.22	161,215,000
1885	11,565,000	73.70	852,283,000	1,973,000	82.38	162,497,000
1886	12,078,000	71.27	860,823,000	2,053,000	79.60	163,381,000
1887	12,497,000	72.15	901,686,000	2,117,000	78.91	167,058,000
1888	13,173,000	71.82	946,096,000	2,192,000	79.78	174,854,000
1889	13,663,000	71.89	982,195,000	2,258,000	79.49	179,444,000
1890	14,214,000	68.84	978,517,000	2,331,000	78.25	182,394,000
1891	14,057,000	67.00	941,823,000	2,297,000	77.88	178,847,000
1892	15,498,000	65.01	1,007,594,000	2,315,000	75.55	174,882,000
1893	16,207,000	61.22	992,225,000	2,331,000	70.68	164,764,000
1894	16,081,000	47.83	769,225,000	2,352,000	62.17	146,233,000
1895	15,893,000	36.29	576,731,000	2,333,000	47.55	110,928,000
1896	15,124,000	33.07	500,140,000	2,279,000	45.29	103,204,000
1897	14,365,000	31.51	452,649,000	2,216,000	41.66	92,302,000
1898	13,961,000	34.26	478,362,000	2,190,000	43.88	96,110,000
1899	13,665,000	37.40	511,075,000	2,134,000	44.96	95,963,000
1900	13,538,000	44.61	603,969,000	2,086,000	53.55	111,717,000
1901	16,745,000	52.86	885,200,000	2,864,000	63.97	183,232,000
1902	16,531,000	58.61	968,935,000	2,757,000	67.61	186,412,000
1903	16,557,000	62.25	1,030,706,000	2,728,000	72.49	197,753,000
1904	16,736,000	67.93	1,136,940,000	2,758,000	78.88	217,533,000
1905	17,058,000	70.37	1,200,310,000	2,889,000	87.18	251,840,000
1906	18,719,000	80.72	1,510,890,000	3,404,000	98.31	334,681,000
1907	19,747,000	93.51	1,846,578,000	3,817,000	112.16	428,064,000
1908	19,992,000	93.41	1,867,530,000	3,869,000	107.76	416,939,000
1909	20,640,000	95.64	1,974,052,000	4,053,000	107.84	437,082,000
1910	21,040,000	108.19	2,276,363,000	4,123,000	119.84	494,095,000
1911	20,277,000	111.46	2,259,981,000	4,323,000	125.92	544,359,000
1912	20,509,000	105.94	2,172,694,000	4,362,000	120.51	525,657,000

HORSES AND MULES—Continued.

Number, average price, and farm value of horses and mules on farms in the United States, January 1, 1911 and 1912.

State and Division.	Horses.						Mules.					
	Number Jan. 1.[1]		Average price per head Jan. 1.		Farm value Jan. 1.[1]		Number Jan. 1.[1]		Average price per head Jan. 1.		Farm value Jan. 1.[1]	
	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911
Maine	109	109	$127.00	$124.00	$13,843	$13,516						
New Hampshire	46	46	126.00	118.00	5,796	5,428						
Vermont	84	82	121.00	121.00	10,164	9,922						
Massachusetts	64	64	144.00	148.00	9,216	9,472						
Rhode Island	10	10	150.00	148.00	1,500	1,480						
Connecticut	47	47	131.00	142.00	6,157	6,674						
New York	609	597	133.00	131.00	80,997	78,207	4	4	$150.00	$143.00	$600	$572
New Jersey	91	91	143.00	142.00	13,013	12,922	4	4	160.00	155.00	640	620
Pennsylvania	572	566	130.00	137.00	74,360	77,542	44	44	147.00	148.00	6,468	6,512
North Atlantic	1,632	1,612	131.77	133.48	215,046	215,163	52	52	148.23	148.15	7,708	7,704
Delaware	34	34	108.00	108.00	3,672	3,672	6	6	133.00	133.00	798	798
Maryland	163	161	112.00	110.00	18,256	17,710	23	23	140.00	136.00	[illegible],220	3,128
Virginia	340	340	109.00	110.00	37,060	37,400	61	61	126.00	130.00	7,686	7,930
West Virginia	182	182	113.00	117.00	20,566	21,294	12	12	122.00	122.00	1,464	1,464
North Carolina	17[illegible]	168	126.00	126.00	21,798	21,168	182	178	144.00	146.00	26,208	25,988
South Carolina	82	80	135.00	138.00	11,070	11,040	166	164	165.00	173.00	27,390	28,372
Georgia	124	122	132.00	130.00	16,368	15,860	310	304	158.00	163.00	48,980	49,552
Florida	52	49	106.00	113.00	5,512	5,537	25	24	154.00	161.00	3,850	3,864
South Atlantic	1,150	1,136	116.78	117.68	134,302	133,681	785	772	152.35	156.86	119,596	121,096
Ohio	901	910	126.00	133.00	113,526	121,030	24	24	127.00	129.00	3,048	3,096
Indiana	838	830	118.00	128.00	98,884	106,240	84	84	124.00	130.00	10,416	10,920
Illinois	1,497	1,482	115.00	123.00	172,155	182,286	151	151	123.00	130.00	18,573	19,630
Michigan	634	622	131.00	129.00	83,054	80,238	4	4	135.00	130.00	540	520
Wisconsin	652	627	124.00	122.00	80,848	76,494	3	3	125.00	122.00	375	366
N. C. E. Miss. R.	4,522	4,471	121.29	126.66	548,467	566,288	266	266	123.88	129.82	32,952	34,532
Minnesota	806	783	116.00	120.00	93,496	93,960	6	6	119.00	119.00	714	714
Iowa	1,568	1,537	113.00	121.00	177,184	185,977	57	57	119.00	126.00	6,783	7,182
Missouri	1,095	1,084	102.00	109.00	111,690	118,156	333	336	115.00	123.00	38,295	41,328
North Dakota	691	671	114.00	110.00	78,774	73,810	8	8	127.00	122.00	1,016	976
South Dakota	675	696	92.00	106.00	62,100	73,776	13	13	108.00	116.00	1,404	1,508
Nebraska	1,059	1,038	91.00	106.00	96,369	110,028	85	85	106.00	119.00	9,010	10,115
Kansas	1,169	1,181	96.00	107.00	112,224	126,367	218	218	108.00	116.00	23,544	25,288
N. C. W. Miss. R.	7,063	6,990	103.62	111.88	731,837	782,074	720	723	112.18	120.49	80,766	87,111
Kentucky	443	447	107.00	108.00	47,401	48,276	234	236	118.00	122.00	27,612	28,792
Tennessee	354	354	114.00	114.00	40,356	40,356	279	276	123.00	126.00	34,317	34,776
Alabama	143	140	99.00	104.00	14,157	14,560	265	257	127.00	130.00	33,655	33,410
Mississippi	234	227	89.00	92.00	20,826	20,884	277	266	113.00	115.00	31,301	30,590
Louisiana	187	183	79.00	83.00	14,773	15,189	134	133	116.00	119.00	15,544	15,827
Texas	1,158	1,147	74.00	80.00	85,692	91,760	703	696	104.00	108.00	73,112	75,168
Oklahoma	750	765	76.00	86.00	57,000	65,790	272	278	98.00	113.00	26,656	31,414
Arkansas	265	260	86.00	92.00	22,790	23,920	228	224	110.00	120.00	25,080	26,880
South Central	3,534	3,523	85.74	91.04	302,995	320,735	2,392	2,366	111.74	117.01	267,277	276,857
Montana	347	344	87.00	87.00	30,189	29,928	4	4	91.00	107.00	364	428
Wyoming	159	156	69.00	79.00	10,971	12,324	2	2	99.00	107.00	198	214
Colorado	321	312	80.00	89.00	25,680	27,768	17	16	100.00	105.00	1,700	1,680
New Mexico	185	178	50.00	50.00	9,250	8,900	15	15	86.00	82.00	1,290	1,230
Arizona	104	100	69.00	59.00	7,176	5,900	4	4	118.00	104.00	472	416
Utah	131	124	93.00	87.00	12,183	10,788	2	2	85.00	83.00	170	166
Nevada	72	70	77.00	84.00	5,544	5,880	3	3	82.00	97.00	246	291
Idaho	214	208	96.00	104.00	20,544	21,632	4	4	112.00	118.00	448	472
Washington	293	287	107.00	108.00	31,351	30,996	14	13	112.00	123.00	1,568	1,599
Oregon	289	283	102.00	111.00	29,478	31,413	10	10	111.00	112.00	1,110	1,120
California	493	483	117.00	117.00	57,681	56,511	72	71	136.00	133.00	9,792	9,443
Far Western	2,608	2,545	92.04	95.10	240,047	242,040	147	144	118.08	118.47	17,358	17,059
United States	20,509	20,277	105.94	111.46	2,172,694	2,259,981	4,362	4,323	120.51	125.92	525,657	544,359

[1] Expressed in thousands; 000 omitted.

HORSES AND MULES—Continued.

Imports, exports, and average prices of horses and mules, 1892–1911.

Year ending June 30—	Imports of horses.			Exports of horses.			Exports of mules.		
	Number.	Value.	Average import price.	Number.	Value.	Average export price.	Number.	Value.	Average export price.
1892	14,074	$2,455,868	$174.50	3,226	$611,188	$189.46	1,965	$238,591	$121.42
1893	15,451	2,388,267	154.57	2,967	718,607	242.20	1,634	210,278	128.69
1894	6,166	1,319,572	214.01	5,246	1,108,995	211.40	2,063	240,961	116.80
1895	13,098	1,055,191	80.56	13,984	2,209,298	157.99	2,515	186,452	74.14
1896	9,991	662,591	66.32	25,126	3,530,703	140.52	5,918	406,161	68.63
1897	6,998	464,808	66.42	39,532	4,769,265	120.64	7,473	545,331	72.97
1898	3,085	414,899	134.49	51,150	6,176,569	120.75	8,098	664,789	82.09
1899	3,042	551,050	181.15	45,778	5,444,342	118.93	6,755	516,908	76.52
1900	3,102	596,592	192.32	64,722	7,612,616	117.62	43,369	3,919,478	90.38
1901	3,785	985,738	260.43	82,250	8,873,845	107.89	34,405	3,210,267	93.31
1902	4,832	1,577,234	326.41	103,020	10,048,046	97.53	27,586	2,692,298	97.60
1903	4,999	1,536,296	307.32	34,007	3,152,159	92.69	4,294	521,725	121.47
1904	4,726	1,460,287	308.99	42,001	3,189,100	75.93	3,658	412,971	112.90
1905	5,180	1,591,083	307.16	34,822	3,175,259	91.19	5,826	645,464	110.79
1906	6,021	1,716,675	285.11	40,087	4,365,981	108.91	7,167	989,639	138.08
1907	6,080	1,978,105	325.35	33,882	4,359,957	131.99	6,781	850,901	125.48
1908	5,487	1,604,392	292.40	19,000	2,612,587	137.50	6,609	990,667	149.90
1909	7,084	2,007,276	283.35	21,616	3,386,617	156.67	3,432	472,017	137.53
1910	11,620	3,296,022	283.65	28,910	4,081,157	141.17	4,512	614,094	136.10
1911	9,593	2,692,074	280.63	25,145	3,845,253	152.92	6,585	1,070,051	162.50

CATTLE.

Imports, exports, and average prices of live cattle, 1892–1911.

Year ending June 30—	Imports.			Exports.		
	Number.	Value.	Average import price.	Number.	Value.	Average export price.
1892	2,168	$47,466	$21.89	394,607	$35,099,095	$88.95
1893	3,293	45,682	13.87	287,094	26,032,428	90.68
1894	1,592	18,704	11.75	359,278	33,461,922	93.14
1895	149,781	765,853	5.11	331,722	30,603,796	92.26
1896	217,826	1,509,856	6.93	372,461	34,560,672	92.79
1897	328,977	2,589,857	7.87	392,190	36,357,451	92.70
1898	291,589	2,913,223	9.99	439,255	37,827,500	86.12
1899	199,752	2,320,362	11.62	389,490	30,516,833	78.35
1900	181,006	2,257,694	12.47	397,286	30,635,153	77.11
1901	146,022	1,931,433	13.23	459,218	37,566,980	81.81
1902	96,027	1,608,722	16.75	392,884	29,902,212	76.11
1903	66,175	1,161,548	17.55	402,178	29,848,936	74.22
1904	16,056	310,737	19.35	593,409	42,256,291	71.21
1905	27,855	458,572	16.46	567,806	40,598,048	71.50
1906	29,019	548,430	18.90	584,239	42,081,170	72.03
1907	32,402	565,122	17.44	423,051	34,577,392	81.73
1908	92,356	1,507,310	16.32	349,210	29,339,134	84.02
1909	139,184	1,999,422	14.37	207,542	18,046,976	86.96
1910	195,938	2,999,824	15.37	139,430	12,200,154	87.50
1911	182,923	2,953,077	16.14	150,100	13,163,920	87.70

CATTLE—Continued.

Number and value of milch cows and other cattle on farms in the United States, 1867–1912.

January 1—	Milch cows.			Other cattle.		
	Number.	Price per head Jan. 1.	Farm value Jan. 1.	Number.	Price per head Jan. 1.	Farm value Jan. 1.
1867	8,349,000	$28.74	$239,947,000	11,731,000	$15.79	$185,254,000
1868	8,692,000	26.56	230,817,000	11,942,000	15.06	179,888,000
1869	9,248,000	29.15	269,610,000	12,185,000	18.73	228,183,000
1870	10,096,000	32.70	330,175,000	15,388,000	18.87	290,401,000
1871	10,023,000	33.89	339,701,000	16,212,000	20.78	336,860,000
1872	10,304,000	29.45	303,438,000	16,390,000	18.12	296,932,000
1873	10,576,000	26.72	282,559,000	16,414,000	18.06	296,448,000
1874	10,705,000	25.63	274,326,000	16,218,000	17.55	284,703,000
1875	10,907,000	25.74	280,701,000	16,313,000	16.91	275,872,000
1876	11,085,000	25.61	283,879,000	16,785,000	17.00	285,387,000
1877	11,261,000	25.47	286,778,000	17,956,000	15.99	287,156,000
1878	11,300,000	25.74	290,898,000	19,223,000	16.72	321,346,000
1879	11,826,000	21.71	256,721,000	21,408,000	15.38	329,254,000
1880	12,027,000	23.27	279,899,000	21,231,000	16.10	341,761,000
1881	12,369,000	23.95	296,277,000	20,939,000	17.33	362,862,000
1882	12,612,000	25.89	326,489,000	23,280,000	19.89	463,070,000
1883	13,126,000	30.21	396,575,000	28,046,000	21.81	611,549,000
1884	13,501,000	31.37	423,487,000	29,046,000	23.52	683,229,000
1885	13,905,000	29.70	412,903,000	29,867,000	23.25	694,383,000
1886	14,235,000	27.40	389,986,000	31,275,000	21.17	661,956,000
1887	14,522,000	26.08	378,790,000	33,512,000	19.79	663,138,000
1888	14,856,000	24.65	366,252,000	34,378,000	17.79	611,751,000
1889	15,299,000	23.94	366,226,000	35,032,000	17.05	597,237,000
1890	15,953,000	22.14	353,152,000	36,849,000	15.21	560,625,000
1891	16,020,000	21.62	346,398,000	36,876,000	14.76	544,128,000
1892	16,416,000	21.40	351,378,000	37,651,000	15.16	570,749,000
1893	16,424,000	21.75	357,300,000	35,954,000	15.24	547,882,000
1894	16,487,000	21.77	358,999,000	36,608,000	14.66	536,790,000
1895	16,505,000	21.97	362,602,000	34,364,000	14.06	482,999,000
1896	16,138,000	22.55	363,956,000	32,085,000	15.86	508,928,000
1897	15,942,000	23.16	369,240,000	30,508,000	16.65	507,929,000
1898	15,841,000	27.45	434,814,000	29,264,000	20.92	612,297,000
1899	15,990,000	29.66	474,234,000	27,994,000	22.79	637,931,000
1900	16,292,000	31.60	514,812,000	27,610,000	24.97	689,486,000
1901	16,834,000	30.00	505,093,000	45,500,000	19.93	906,644,000
1902	16,697,000	29.23	488,130,000	44,728,000	18.76	839,126,000
1903	17,105,000	30.21	516,712,000	44,659,000	18.45	824,055,000
1904	17,420,000	29.21	508,841,000	43,629,000	16.32	712,178,000
1905	17,572,000	27.44	482,272,000	43,669,000	15.15	661,571,000
1906	19,794,000	29.44	582,789,000	47,068,000	15.85	746,172,000
1907	20,968,000	31.00	645,497,000	51,566,000	17.10	881,557,000
1908	21,194,000	30.67	650,057,000	50,073,000	16.89	845,938,000
1909	21,720,000	32.36	702,945,000	49,379,000	17.49	863,754,000
1910	21,801,000	35.79	780,308,000	47,279,000	19.41	917,453,000
1911	20,823,000	39.97	832,209,000	39,679,000	20.54	815,184,000
1912	20,699,000	39.39	815,414,000	37,260,000	21.20	790,064,000

CATTLE—Continued.

Number, average price per head, and farm value of cattle on farms in the United States January 1, 1911 and 1912.

State and Division.	Milch cows. Number, Jan. 1.[1]		Milch cows. Average price per head, Jan. 1.		Milch cows. Farm value, Jan. 1.[1]		Other cattle. Number, Jan. 1.[1]		Other cattle. Average price per head, Jan. 1.		Other cattle. Farm value, Jan. 1.[1]	
	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911	1912	1911
Maine	155	155	$44.00	$44.00	$6,820	$6,820	98	99	$19.80	$21.20	$1,940	$2,099
New Hampshire	97	98	44.00	48.50	4,268	4,753	65	66	21.60	24.90	1,404	1,643
Vermont	268	260	42.00	46.00	11,256	11,960	168	168	18.20	20.00	3,058	3,360
Massachusetts	167	170	50.00	49.00	8,350	8,330	80	80	18.80	19.90	1,504	1,592
Rhode Island	23	23	50.40	52.50	1,159	1,208	11	11	20.00	19.60	220	216
Connecticut	120	122	49.20	49.00	5,904	5,978	71	72	21.00	21.90	1,491	1,577
New York	1,495	1,510	43.30	48.50	64,734	73,235	894	922	19.80	22.20	17,701	20,468
New Jersey	150	152	53.20	53.50	7,980	8,132	68	69	24.10	23.70	1,639	1,635
Pennsylvania	943	953	43.70	44.50	41,209	42,408	627	640	21.70	21.40	13,606	13,696
N. Atlantic	3,418	3,443	44.38	47.29	151,680	162,824	2,082	2,127	20.44	21.76	42,563	46,286
Delaware	37	37	37.00	42.50	1,369	1,572	19	19	22.00	22.30	418	424
Maryland	168	168	37.00	37.50	6,216	6,300	119	121	21.40	22.00	2,547	2,662
Virginia	352	356	31.40	32.00	11,053	11,392	478	503	19.90	20.40	9,512	10,261
West Virginia	230	240	33.80	35.50	7,774	8,520	331	380	22.10	23.80	7,315	9,044
North Carolina	312	312	28.00	28.00	8,736	8,736	380	388	12.60	13.40	4,788	5,199
South Carolina	185	185	32.30	31.50	5,976	5,828	215	215	13.20	13.00	2,838	2,795
Georgia	406	402	28.00	28.50	11,368	11,457	667	667	11.00	11.60	7,337	7,737
Florida	123	118	33.50	35.00	4,120	4,130	758	736	13.10	12.40	9,930	9,126
S. Atlantic	1,813	1,818	31.23	31.87	56,612	57,935	2,967	3,029	15.06	15.60	44,685	47,248
Ohio	887	896	42.00	47.00	37,254	42,112	885	942	24.30	24.80	21,506	23,362
Indiana	634	640	41.00	44.50	25,994	28,480	707	744	24.50	25.70	17,322	19,121
Illinois	1,049	1,060	45.50	47.00	47,730	49,820	1,266	1,391	26.60	26.30	33,676	36,583
Michigan	806	798	40.50	43.50	32,643	34,713	701	738	18.80	19.90	13,179	14,686
Wisconsin	1,504	1,489	40.40	42.50	60,762	63,282	1,146	1,146	18.00	17.50	20,628	20,055
N. C. E. Miss. R	4,880	4,883	41.88	44.73	204,383	218,407	4,705	4,961	22.60	22.94	106,311	113,807
Minnesota	1,107	1,085	36.60	36.00	40,516	39,060	1,151	1,224	15.30	15.00	17,610	18,360
Iowa	1,393	1,407	40.80	40.00	56,834	56,280	2,773	2,919	25.00	24.10	69,325	70,348
Missouri	822	856	40.20	39.50	33,044	33,812	1,504	1,671	25.30	24.60	38,051	41,107
North Dakota	272	267	37.00	35.50	10,064	9,478	446	451	21.00	19.10	9,366	8,614
South Dakota	366	381	38.00	35.50	13,908	13,526	894	1,118	22.20	21.80	19,847	24,372
Nebraska	613	626	40.60	37.50	24,888	23,475	2,002	2,225	24.50	22.50	49,049	50,062
Kansas	698	743	41.00	40.00	28,618	29,720	1,872	2,202	26.40	25.30	49,421	55,711
N. C. W. Miss. R	5,271	5,365	39.42	38.28	207,872	205,351	10,642	11,810	23.74	22.74	252,669	268,574
Kentucky	398	406	35.30	36.50	14,049	14,819	561	591	21.10	20.90	11,837	12,352
Tennessee	385	393	32.00	31.00	12,320	12,183	576	594	14.70	15.00	8,467	8,910
Alabama	396	392	26.00	25.00	10,296	9,800	540	540	9.60	9.10	5,184	4,914
Mississippi	443	439	26.00	27.00	11,518	11,853	566	566	10.00	9.70	5,660	5,490
Louisiana	288	285	29.50	29.50	8,496	8,408	516	521	11.20	11.60	5,779	6,044
Texas	1,034	1,034	35.10	34.00	36,293	35,156	5,177	5,507	17.00	16.70	88,009	91,967
Oklahoma	504	531	35.40	37.00	17,842	19,647	1,242	1,395	21.50	21.50	26,703	29,992
Arkansas	404	417	27.00	27.50	10,908	11,468	538	572	11.40	10.70	6,133	6,120
S. Central	3,852	3,897	31.60	31.65	121,722	123,334	9,716	10,286	16.24	16.12	157,772	165,789
Montana	91	85	49.40	48.50	4,495	4,122	732	813	29.80	27.60	21,814	22,439
Wyoming	35	34	48.00	45.00	1,680	1,530	568	624	28.80	26.60	16,358	16,598
Colorado	167	164	47.00	44.50	7,849	7,298	921	969	27.60	24.80	25,420	24,031
New Mexico	53	51	43.00	42.50	2,279	2,168	900	928	23.40	19.80	21,060	18,374
Arizona	32	31	51.00	48.50	1,632	1,504	741	764	23.30	20.50	17,265	15,662
Utah	83	80	40.00	39.00	3,320	3,120	356	356	21.50	19.30	7,654	6,871
Nevada	20	18	50.00	48.00	1,000	864	429	429	26.10	24.90	11,197	10,682
Idaho	94	90	48.50	43.50	4,559	3,915	343	346	25.50	21.70	8,746	7,508
Washington	205	193	54.00	45.00	11,070	8,685	186	194	24.40	21.90	4,538	4,249
Oregon	180	176	47.20	42.00	8,496	7,392	457	497	25.30	21.60	11,562	10,735
California	505	495	53.00	48.00	26,765	23,760	1,515	1,546	26.70	23.50	40,450	36,331
Far Western	1,465	1,417	49.93	45.42	73,145	64,358	7,148	7,466	26.03	23.24	186,064	173,480
United States	20,699	20,823	39.39	39.97	815,414	832,209	37,260	39,679	21.20	20.54	790,064	815,184

[1] Expressed in thousands; 000 omitted.

CATTLE—Continued.

Wholesale prices of cattle per 100 pounds, 1898–1911.

Date.	Chicago. Inferior to prime.		Cincinnati. Fair to medium.		St. Louis. Good to choice native steers.		Kansas City. Common to prime.	
	Low	High.	Low.	High.	Low.	High.	Low.	High.
1898	$2.25	$6.25	$3.10	$4.25	$4.00	$5.65	$3.50	$5.65
1899	2.00	7.00	3.00	4.50	4.00	6.00	3.75	6.80
1900	1.75	6.60	3.00	4.70	4.00	6.50	3.90	6.50
1901	2.10	7.00	2.90	5.05	4.75	8.25	4.00	7.00
1902	1.90	14.50	3.00	5.40	5.15	8.75	4.10	8.75
1903	1.50	8.35	2.25	4.40	5.00	6.00	3.75	6.00
1904	1.70	7.65	2.25	4.25	4.90	6.60	4.25	7.00
1905	1.85	7.00	2.35	4.75	5.15	7.10	4.00	7.05
1906	1.75	7.90	2.35	4.50	5.45	7.00	4.10	7.50
1907	2.00	8.00	4.10	6.00	5.35	7.35	3.90	8.25
1908.								
January	2.00	6.40	3.25	4.50	5.50	5.80	3.90	5.75
February	2.00	6.25	3.25	4.50	5.70	5.80	4.00	5.85
March	2.25	7.35	3.50	5.00	5.75	7.15	4.25	7.15
April	2.50	7.40	4.00	5.50	6.90	7.35	4.90	7.00
May	2.50	7.40	3.90	5.25	7.00	7.20	4.60	7.25
June	2.50	8.40	4.00	5.25	7.15	8.25	4.65	8.25
July	2.30	8.25	3.50	5.00	7.45	8.00	3.70	8.10
August	2.25	7.90	3.15	4.75	6.75	7.50	3.50	7.50
September	2.10	7.85	2.75	4.25	6.75	7.75	3.65	7.60
October	2.00	7.60	2.65	4.25	6.85	7.50	4.10	8.00
November	2.25	8.00	3.00	4.40	7.10	7.60	4.00	7.35
December	2.30	8.00	3.25	4.75	6.90	8.00	3.65	8.00
Year	2.00	8.40	2.65	5.50	5.50	8.25	3.50	8.25
1909.								
January	2.90	7.50	3.60	5.00	5.70	7.00	4.00	6.90
February	3.00	7.15	3.85	4.75	6.15	6.75	4.00	6.75
March	3.05	7.40	3.85	5.00	6.75	7.00	4.50	7.10
April	3.15	7.15	3.85	4.90	6.75	7.00	4.15	6.75
May	3.30	7.30	4.00	5.25	6.60	7.00	4.00	7.00
June	3.15	7.25	3.75	5.50	7.00	7.15	4.25	7.25
July	3.10	7.45	3.50	5.25	7.00	7.40	4.10	7.65
August	3.00	8.00	3.35	5.25	7.10	7.65	3.90	7.80
September	3.00	8.50	3.25	5.00	7.50	8.50	3.70	8.25
October	3.05	9.10	3.00	4.85	8.00	8.75	4.00	10.25
November	3.05	9.25	3.25	4.85	7.25	8.25	4.35	9.00
December	3.00	9.50	3.50	5.10	6.40	10.50	4.35	10.50
Year	2.90	9.50	3.00	5.50	5.70	10.50	3.70	10.50
1910.								
January	2.90	8.40	3.35	5.00	6.75	7.50	4.35	7.40
February	3.00	8.10	3.35	5.25	6.75	7.35	4.75	7.50
March	3.25	8.85	4.50	6.25	7.50	8.50	5.40	8.40
April	3.50	8.75	4.35	6.50	8.00	8.35	5.75	8.40
May	4.25	8.75	4.00	6.25	7.75	8.50	5.40	8.30
June	3.00	8.85	3.75	6.00	8.20	8.60	4.50	8.50
July	3.00	8.60	3.65	5.75	8.00	8.25	3.60	8.25
August	3.15	8.50	3.00	5.35	7.85	8.25	3.75	8.25
September	3.15	8.50	3.10	5.25	7.50	7.90	4.00	8.10
October	3.00	8.20	3.00	4.90	7.25	8.00	3.90	8.60
November	3.00	7.75	3.25	4.65	6.80	7.35	4.20	7.35
December	3.00	7.55	3.65	4.85	6.35	7.75	4.30	7.35
Year	2.90	8.85	3.00	6.50	6.35	8.50	3.60	8.60
1911.								
January	3.25	7.10	3.75	5.00	6.75	6.80	5.00	6.75
February	3.40	7.05	4.00	5.00	6.60	6.90	5.05	6.75
March	3.40	7.05	4.00	5.00	6.50	6.75	5.15	6.75
April	3.25	6.90	3.75	5.00	6.50	6.75	5.00	6.60
May	3.35	6.50	3.60	5.10	6.25	6.60	5.00	6.35
June	2.65	6.75	3.75	5.00	6.25	6.40	4.25	6.50
July	2.50	7.35	3.50	5.10	6.50	7.00	4.25	7.20
August	2.50	8.20	3.25	5.00	7.00	8.00	4.25	8.20
September	3.00	8.25	3.65	5.25	7.95	8.25	4.50	8.15
October	2.85	9.00	3.25	4.85	7.90	8.50	4.50	12.55
November	2.75	9.25	3.25	4.75	7.60	9.00	4.75	9.25
December	3.00	9.35	3.50	5.35	7.80	9.40	4.50	10.00
Year	2.50	9.35	3.25	5.35	6.25	9.40	4.25	12.55

BUTTER.

Wholesale prices of butter per pound, 1896–1911.

Date.	Elgin. Creamery, extra. Low.	Elgin. Creamery, extra. High.	Chicago. Creamery, extra. Low.	Chicago. Creamery, extra. High.	Chicago. Dairies, firsts to extras. Low.	Chicago. Dairies, firsts to extras. High.	Cincinnati. Creamery, extra. Low.	Cincinnati. Creamery, extra. High.	Milwaukee. Creamery, fancy. Low.	Milwaukee. Creamery, fancy. High.	New York. Creamery, extra. Low.	New York. Creamery, extra. High.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
1896	14	24½	12	24	10	20	12	20	9	23½	14	25
1897	13⅝	23	12½	23	10	20	12	22	8	23	15	24
1898	15	22	14	22	11½	19	13	20	11	22	15	23½
1899	16	27	14	27	11	22	16	24	9½	27	16½	28
1900	18	29	15½	29	14½	25	16	27	19	29½	17½	30
1901	18½	24½	15	24½	14	20	17	24	18½	25	18	25½
1902	19	30	16	31	15½	29	17	27	19½	30½	19	33
1903	18½	29	16	28½	15	25	15½	27	18½	28½	19	29½
1904	17	28	15	28	12½	24	17	28	17	27	17½	28
1905	19½	34	18	34	16	30	19	34	19½	34	17½	35½
1906	19	31½	16½	31	15	27	19	32½	19	31½	19¼	33
1907	23	33	18	32½	18	30	23	34	23	33	23½	35
1908.												
January	29½	32	24	31	21	28	29	34½	29	32	29	32½
February	32	33	26	33½	22	29	32	36	31	33½	30	34
March	29	31	25	31	22	28	29	34½	29	31	28	30
April	26½	30	22	30	22	26	26½	32½	27	30	26½	30½
May	22	26	19	25	17	24	22	28½	22	27	21½	26½
June	23	23	20	23	19	21	23	25½	23	23	22	24
July	22	23	20	22½	18	21	22	25½	22	23	22	23
August	21	23	19	22½	18	20	21	25½	21	23	21¼	23½
September	23	26	20	24	18	20	23	28½	23	26	23½	25½
October	27½	27½	21	27½	18	24	25½	30	26	27½	26	27½
November	28	30	22	30	20	25	27	32½	27½	30	27	31
December	30	32	25	31	22	25	29½	34½	30	32	30½	33
Year	21	33	19	33½	18	29	21	36	21	33½	21¼	34
1909.												
January	29	32	24	32	22	27	31	34	17	32	29	33
February	29	30	24	30	22	25	31	32	16	30	29	31½
March	29	30	25	29	22	25½	31	32	16	30	28½	30½
April	26	30	24	29½	20½	25½	28	30	16	30	26	29½
May	24	27	22	27	20	24½	26	29	15	26	26	29½
June	25	26½	23	27	21½	24½	27	28½	15	26½	25	26¾
July	25½	26½	23	26	21½	23½	27½	28½	16	26½	25½	27
August	26	29	23	28	21½	25	28	31	17	29	26	29
September	30	30	25	29½	23	26	32	32	18	30	29	31
October	30	31	26	30½	24	28	32	33	18	31	30	31½
November	30	32½	27½	31	26	28	32½	35	20	32½	30	32
December	33	36	28½	35	26	30	35½	38½	22	35	33	37
Year	24	36	22	35	20	30	26	38½	15	35	25	37
1910.												
January	30	36	27	36	26	30	32½	38½	20	36	30	35
February	28	31	26	30	23	29	30½	33½	19	31	27½	30
March	31	32	27	32	25	27	33½	34½	19	32	32	34
April	29	32	26½	32½	24	28	32	35	18	32	29	34
May	27	29	25	28	23	26	29½	31½	18	29	27¾	28½
June	27	28	25½	27½	23½	26	29½	30	19	28	27½	28¾
July	27	28	24	28	23½	25½	29½	30½	19	28	27½	29
August	28	30	24	29	23½	27	30½	32½	19	30	28	31
September	29	31	25	30	25	27	31½	33½	20	31	29	31
October	29	30½	25	29½	25	27	31½	32	20	29½	29	30½
November	30	31	26½	30½	25	27	32½	33½	21	31	30	31
December	29	30	25½	30	23	27	31½	32½	20½	31	29	30
Year	27	36	24	36	23	30	29½	38½	18	36	27½	35

BUTTER—Continued.

Wholesale prices of butter per pound, 1896-1911—Continued.

Date.	Elgin.		Chicago.				Cincinnati.		Milwaukee.		New York.	
	Creamery, extra.		Creamery, extra.		Dairies, firsts to extras.		Creamery, extra.		Creamery, fancy.		Creamery, extra.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1911.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	25	29	20	29	19	25	27½	32½	25	30	25	29
February	25	26½	20	26½	19	22	27½	29	25	26½	24	27½
March	24	26	20	26½	17	22	26½	28½	24	26	19½	26
April	21	24	18	22	15	19	23½	26½	21	24	19½	22
May	21	23	18	22	15	20	23½	25½	21	23	21	25
June	21½	23	18	23	17	21	24	25½	21½	23	21½	24
July	23	26	20	24	19	22	23½	27½	23	25	24	26
August	26	26	21	26	20	23	28½	28½	26	26	26	27
September	26	26½	21	26	20	25	28½	29	26	26½	26	28
October	27½	31	23	31	22½	28	29	33½	26	31	28	32½
November	31	33	27½	33	25	29	33½	37½	31	35	32	36½
December	35	36	26	37	27	33	37½	38½	35	36	34	39
Year	21	36	18	37	15	33	23½	38½	21	36	19½	39

International trade in butter, 1906-1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	9,712,076	6,691,980	7,825,681	8,802,359	6,341,589
Australia	Jan 1	75,765,536	66,076,915	51,193,311	55,644,925	87,894,943
Austria-Hungary	Jan. 1	9,501,920	7,097,560	9,892,359	5,548,537	4,378,997
Belgium	Jan. 1	3,704,232	3,755,227	3,821,565	3,998,906	3,509,265
Canada	Jan. 1	21,680,489	4,835,497	5,994,144	4,375,004	3,673,702
Denmark	Jan. 1	175,043,639	188,829,579	196,061,115	196,692,759	195,052,426
Finland	Jan. 1	33,192,114	28,024,833	26,525,880	25,644,456	24,471,285
France	Jan. 1	39,307,326	34,648,529	43,951,344	51,263,343	54,357,279
Germany [2]	Jan. 1	953,058	535,062	480,167	450,179	398,592
Italy	Jan. 1	10,746,430	7,835,006	8,602,656	8,028,051	8,295,469
Netherlands	Jan. 1	56,404,861	64,809,205	72,911,951	68,686,019	72,456,276
New Zealand	Jan. 1	35,865,200	36,785,392	25,756,752	35,964,096	39,931,920
Norway	Jan. 1	3,281,403	2,864,267	3,432,508	3,446,165	2,738,708
Russia	Jan. 1	115,972,393	132,113,551	112,789,519	125,627,114	[3] 123,541,889
Sweden	Jan. 1	35,712,817	38,227,303	40,030,708	42,362,456	47,949,953
United States	Jan. 1	24,468,023	3,857,288	8,918,091	2,925,730	3,104,175
Other countries		3,802,267	3,089,024	3,223,000	5,299,000	[3] 5,045,000
Total		655,113,784	630,076,218	621,410,751	644,759,099	683,141,468

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Australia	Jan. 1	70,143	20,885	40,874	80,111	71,695
Belgium	Jan. 1	11,128,520	12,529,438	10,998,273	12,718,269	12,495,992
Brazil	Jan. 1	5,344,412	5,451,126	4,122,650	4,944,999	[4] 4,944,999
British South Africa	Jan. 1	11,273,748	7,533,108	7,445,086	4,512,895	3,645,416
Denmark	Jan. 1	13,049,158	8,429,437	4,376,175	6,728,836	6,240,561
Dutch East Indies	Jan. 1	3,433,031	3,807,470	3,239,267	3,553,612	[3] 3,474,789
Egypt	Jan. 1	2,958,784	3,521,070	2,970,514	2,480,303	2,936,170
France	Jan. 1	11,402,808	14,671,596	12,374,543	10,748,748	10,664,973
Germany [2]	Jan. 1	80,896,179	85,565,569	74,623,809	98,721,988	92,815,865
Netherlands	Jan. 1	5,630,865	3,332,634	2,396,806	4,238,072	4,491,879
Russia	Jan. 1	1,914,484	781,842	914,954	1,089,054	[3] 1,300,061
Sweden	Jan. 1	1,316,117	1,498,453	275,628	398,499	205,352
Switzerland	Jan. 1	7,822,660	7,914,152	8,211,776	9,283,130	11,062,683
United Kingdom	Jan. 1	477,092,448	462,175,280	465,443,216	446,935,664	476,805,840
Other countries		17,973,778	21,233,001	17,313,000	22,184,000	[3] 25,298,000
Total		651,307,135	638,465,061	614,746,571	628,618,180	656,454,275

[1] See "General note," p. 526.
[2] Not including free ports prior to Mar. 1, 1906.
[3] Preliminary.
[4] Year preceding.

BUTTER AND EGGS.

Average price received by farmers on the first of each month of 1911.

State and Division.	Butter, cents per pound.												Eggs, cents per dozen.											
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Maine	31	29	29	26	26	26	24	25	28	29	31	31	38	28	22	19	17	18	20	22	27	28	34	40
New Hampshire	32	31	29	27	26	28	27	28	31	31	31	32	39	27	26	21	20	20	22	25	30	32	35	41
Vermont	31	29	28	26	24	24	24	24	28	31	30	32	39	28	22	19	18	18	19	22	26	28	30	40
Massachusetts	36	34	31	30	29	28	30	30	32	32	34	35	43	35	29	24	23	25	26	30	34	34	40	49
Rhode Island	34	31	30	28	28	27	29	28	29	32	32	35	48	35	28	21	22	25	27	30	35	37	41	50
Connecticut	35	34	31	29	26	30	29	30	31	33	33	34	45	30	26	21	20	22	27	32	32	37	40	50
New York	32	29	26	26	24	24	24	26	28	28	31	33	41	28	23	19	17	18	19	23	25	27	33	38
New Jersey	36	32	31	30	27	29	28	30	31	31	32	36	44	28	23	20	19	21	21	24	28	30	34	41
Pennsylvania	34	30	27	27	25	23	23	25	27	28	30	33	37	25	20	18	16	17	18	20	21	25	29	35
Delaware	30	26	28	28	26	22	22	25	23	22	26	31	40	22	20	16	17	16	18	18	19	23	30	37
Maryland	29	26	27	26	25	24	23	24	25	27	26	28	34	20	17	15	16	15	16	18	19	22	26	32
Virginia	26	24	24	24	24	22	21	22	23	23	24	24	29	19	16	15	15	15	15	16	18	20	23	27
West Virginia	28	25	24	25	25	23	21	21	24	24	24	25	31	23	17	17	16	16	16	17	18	20	22	28
North Carolina	24	23	22	21	22	22	22	22	23	23	22	24	25	19	15	14	15	14	16	16	17	20	21	23
South Carolina	26	26	25	25	25	25	26	23	25	26	24	25	29	23	18	17	18	17	19	17	20	22	24	25
Georgia	26	24	24	25	24	23	24	23	23	24	25	25	28	23	18	17	17	17	17	17	18	21	24	26
Florida	32	30	29	29	30	30	30	32	31	31	30	34	32	24	20	20	20	20	21	21	22	24	28	31
Ohio	28	21	21	21	21	18	18	20	22	23	24	27	34	20	16	15	15	14	14	16	18	20	25	31
Indiana	25	20	20	20	19	18	18	19	21	22	23	25	30	19	14	14	14	13	13	14	16	19	23	30
Illinois	27	22	21	22	21	19	20	22	23	23	25	27	29	21	15	14	14	14	13	14	15	18	22	28
Michigan	28	24	22	22	20	19	19	20	22	23	25	28	29	24	18	15	15	15	15	16	17	20	24	24
Wisconsin	30	27	24	24	22	21	22	23	25	25	28	31	30	25	17	15	15	15	14	15	16	18	22	26
Minnesota	29	24	22	23	21	20	20	22	24	24	27	30	30	23	16	14	14	14	12	14	16	18	22	27
Iowa	27	22	21	21	20	19	19	22	23	24	25	28	26	21	14	13	14	13	12	12	14	17	20	25
Missouri	23	18	18	19	18	16	17	19	20	19	20	22	26	18	13	12	13	12	10	11	13	16	19	26
North Dakota	26	25	21	20	20	19	16	17	19	21	23	26	30	29	22	15	13	14	13	15	17	18	22	26
South Dakota	28	24	21	20	20	19	18	20	21	22	24	27	29	25	16	13	13	13	13	14	16	18	21	27
Nebraska	25	19	17	17	16	16	16	18	19	20	23	25	26	19	14	13	12	12	11	12	14	16	20	26
Kansas	25	19	18	18	18	17	18	19	20	22	23	26	26	18	13	13	13	12	10	11	14	16	20	26
Kentucky	22	20	19	20	19	17	18	18	18	18	20	22	28	18	13	13	13	12	12	13	14	17	19	26
Tennessee	21	19	19	19	19	17	17	18	18	18	19	20	26	18	13	13	13	13	12	13	15	17	18	24
Alabama	22	22	20	21	20	20	20	19	20	20	21	23	27	21	15	14	14	14	14	15	16	18	20	23
Mississippi	25	23	23	22	21	21	21	21	21	22	22	23	26	21	16	15	15	14	14	15	17	19	20	22
Louisiana	26	26	26	25	25	25	25	24	25	26	26	26	27	22	17	15	16	14	14	16	17	19	22	22
Texas	24	23	21	20	19	18	19	19	19	21	21	22	25	20	14	13	12	12	12	12	14	17	18	22
Oklahoma	25	22	20	20	20	18	18	19	19	21	23	24	26	20	14	12	12	11	11	11	14	16	20	25
Arkansas	24	23	22	22	20	19	20	21	20	21	21	23	26	20	14	12	14	13	11	14	16	18	18	22
Montana	36	37	35	34	31	30	28	27	30	31	32	34	45	42	34	26	22	21	25	25	29	33	33	39
Wyoming	35	31	29	28	26	26	24	28	28	28	30	31	41	34	23	22	19	19	19	23	27	27	31	34
Colorado	33	30	27	27	25	24	23	24	26	28	29	31	36	31	24	19	17	18	19	21	23	26	28	34
New Mexico	34	34	31	33	30	29	31	30	30	32	32	33	35	32	25	24	21	21	24	24	28	29	31	36
Arizona	39	37	35	33	35	34	35	33	33	34	35	37	44	36	30	29	26	30	27	30	32	36	35	41
Utah	32	30	28	27	27	26	25	27	27	28	28	31	35	29	22	16	16	16	16	18	21	23	25	30
Nevada	36	36	38	36	38	35	33	35	34	39	38	37	52	45	35	32	29	29	28	31	34	41	44	46
Idaho	36	36	32	29	27	26	26	28	27	30	31	34	41	34	30	22	19	20	22	24	26	28	31	35
Washington	38	34	31	31	28	28	25	27	30	31	34	36	42	34	27	21	20	21	22	25	29	31	35	40
Oregon	38	35	34	34	30	28	26	28	31	31	32	34	42	36	27	23	21	22	22	25	28	28	32	40
California	36	32	31	29	25	26	26	26	28	30	30	33	38	31	24	18	18	20	22	23	27	33	38	42

BUTTER.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
United States	27.8	24.1	22.7	22.6	21.4	20.3	20.4	21.7	23.1	23.8	25.2	27.4
North Atlantic	32.8	29.7	27.2	26.7	24.8	24.3	24.1	25.7	28.0	28.7	30.7	32.9
South Atlantic	26.4	24.5	24.1	24.2	24.1	22.9	22.5	22.4	23.7	24.1	24.1	25.0
N. C. E. Miss. R	27.6	22.6	21.5	21.7	20.6	18.9	19.0	20.7	22.5	23.1	24.8	27.5
N. C. W. Miss. R	26.0	20.9	19.6	19.8	18.9	17.9	18.0	20.1	21.3	22.0	23.7	26.4
South Central	23.2	21.8	20.7	20.5	19.7	18.5	19.1	19.3	19.3	20.2	20.9	22.3
Far Western	36.0	32.9	31.2	30.1	27.0	26.8	25.7	26.7	28.7	30.2	31.0	33.4

BUTTER AND EGGS—Continued.

Average price received by farmers on the first day of each month of 1911—Continued.

EGGS.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
United States	30.4	22.1	16.5	14.9	14.7	14.5	14.2	15.5	17.4	20.0	23.5	28.7
North Atlantic	39.8	27.6	22.5	19.2	17.5	18.6	19.9	22.8	25.1	27.7	32.6	38.8
South Atlantic	29.6	21.0	16.9	15.8	16.1	15.7	16.4	16.9	18.3	20.8	23.5	27.3
N. C. E. Miss. R.	30.6	21.3	15.8	14.5	14.5	14.1	13.7	15.0	16.4	19.0	23.3	28.3
N. C. W. Miss. R.	26.7	20.1	14.1	12.9	13.3	12.6	11.1	12.0	14.2	16.6	20.1	25.9
South Central	26.2	19.7	14.1	13.2	13.2	12.6	12.2	13.2	15.0	17.4	18.9	23.3
Far Western	39.2	32.7	25.5	20.0	18.9	20.2	21.5	23.3	26.8	30.5	34.2	39.2

Receipts of eggs at seven leading markets in the United States, 1891–1910.

[From Board of Trade, Chamber of Commerce, and Merchants' Exchange Reports.]

Year.	New York.	Chicago.	Boston.	St. Louis.	Cincinnati.	Milwaukee.	San Francisco.	Total.
	Cases.	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*
1891	1,867,681	1,508,417	641,203	501,313	[1] 262,694	90,558	169,022	5,040,888
1892	2,022,008	1,955,696	688,227	469,216	272,661	80,395	176,964	5,665,167
1893	2,113,180	1,718,061	718,653	562,359	318,881	83,432	157,190	5,671,756
1894	2,323,511	2,097,179	781,918	598,773	321,011	97,557	162,712	6,382,661
1895	2,243,349	2,115,974	781,812	654,938	267,494	102,773	164,407	6,330,747
1896	2,633,932	2,301,499	875,518	796,490	361,265	106,565	164,732	7,240,001
1897	2,719,987	1,962,134	912,712	894,906	339,457	115,686	181,407	7,126,289
1898	2,542,090	2,147,950	889,216	898,984	306,423	115,652	203,380	7,103,695
1899	2,624,424	2,096,100	900,219	751,224	389,543	110,696	237,355	7,109,561
1900	2,799,937	2,475,473	986,367	920,682	414,623	118,036	183,563	7,898,681
1901	2,909,194	2,783,709	1,040,555	1,022,646	493,218	128,179	277,500	8,655,001
1902	2,743,642	2,659,340	1,053,165	825,999	464,799	114,732	285,058	8,146,735
1903	2,940,091	3,279,248	1,164,777	959,648	338,327	129,278	335,228	9,146,597
1904	3,215,924	3,113,858	1,122,819	1,216,124	377,263	166,409	319,637	9,532,034
1905	3,477,638	3,117,221	1,395,385	980,257	420,604	159,990	307,243	9,858,338
1906	3,981,013	3,583,878	1,709,531	1,023,125	484,208	187,561	137,074	11,106,390
1907	4,262,153	4,780,356	1,594,576	1,288,977	588,636	176,826	379,439	13,070,963
1908	3,703,990	4,569,014	1,436,786	1,439,868	441,072	207,558	347,436	12,145,724
1909	3,903,867	4,557,906	1,417,397	1,395,987	519,652	160,418	340,185	12,295,412
1910	4,377,413	4,492,483	1,431,686	1,368,280	504,739	169,352	469,698	12,813,651
1911	5,016,721	4,707,335	1,441,748	1,736,803	605,131	170,850	588,052	14,266,640
Averages:								
1891–1895	2,113,946	1,879,065	722,363	557,320	288,548	90,943	166,059	5,818,244
1896–1900	2,664,074	2,196,631	912,807	852,457	362,262	113,327	194,087	7,295,645
1901–1905	3,057,298	2,990,675	1,155,340	1,000,935	418,842	139,718	304,933	9,067,741
1906–1910	4,045,687	4,396,727	1,517,995	1,303,247	507,661	180,343	334,766	12,286,426
1911.								
January	255,316	150,534	26,708	72,347	19,412	2,973	35,310	562,600
February	367,755	190,203	66,674	144,652	60,007	4,784	42,634	876,709
March	636,407	522,578	157,773	249,572	101,662	16,137	68,783	1,752,912
April	775,904	769,663	233,114	270,878	104,818	31,272	71,950	2,257,599
May	847,759	812,434	294,577	237,454	78,024	39,381	72,884	2,382,513
June	550,088	693,276	224,638	189,960	45,301	20,790	54,492	1,778,545
July	343,439	456,327	128,364	122,804	30,949	14,169	51,928	1,147,980
August	398,670	429,900	118,686	111,117	26,134	16,556	56,657	1,157,720
September	320,830	281,388	68,961	95,537	29,071	10,111	37,568	843,466
October	256,233	199,827	53,137	85,121	36,467	6,496	32,438	669,719
November	135,594	125,268	36,741	85,358	25,686	4,754	31,149	444,550
December	128,726	75,937	32,375	72,003	47,600	3,427	32,259	392,327

[1] Year ending Aug. 31. Subsequent years are calendar years.

EGGS—Continued.

Wholesale price of eggs per dozen, 1896–1911.

Date.	Chicago. Fresh.		Cincinnati.		St. Louis. Average best fresh.		Milwaukee. Fresh.		New York. Average best fresh.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents*	*Cents.*	*Cents.*
1896	7½	22	7	17	6	19	7½	22	10½	25
1897	8	22	7	17	6	18	8	20	9¼	25
1898	8½	26	8	20	8	20	8½	23	10	27
1899	10	35	8½	24	9	22	10	30	12½	35
1900	10	26	9	22	8	23	10	24	12	29
1901	10	28	9	27	6	25	10	24	13	31
1902	13¾	32½	13	32	11¼	32	13½	30	15½	37
1903	10	30	12	28	11	28½	12½	27	15	45
1904	11	34½	14½	32	13	29	13½	32	16	47
1905	12	36	14	30	10½	34	14	31	16½	40
1906	11	36	13	29	11½	26	12½	33	14½	45
1907	13	30	13½	29	12	25½	12½	28	16	50
1908.										
January	21	30	19	26	18	21	20	24	23	38
February	19½	27	18	23	17	23	17	22	20	32
March	14	22½	13	18	13	17	13½	20	15	29
April	14¼	16¼	13	14	13	13½	13	13½	15½	20
May	14½	17	13½	15½	13	14	13½	13½	16½	21
June	14	17½	13½	17	12½	14	13½	14	15	24
July	15½	19½	14	17	13½	14½	14	17½	17	26
August	17½	20½	14	21	14½	16	16½	17½	18	30
September	19	23	19	24	16	18½	16½	19	19	35
October	22	27	22	28	18½	23	19	24	22	44
November	26	30	23	34	23	27	25	28	24	50
December	28	33	25	36	25	29	28	32	28	55
Year	14	33	13	36	12½	29	13	32	15	55
1909.										
January	24	36	28	36	26	38	15	30	29	40
February	20	35	21	37	21	40	16	32	24	40
March	17½	20½	17	20	16	18½	14	21	19	25
April	18½	20½	20	22	18	20	14	19½	20½	25
May	19	23	20	22	18	20	15	19½	22	26½
June	17½	21½	19½	21½	17½	19	15	19½	21½	29
July	18	22½	20½	22½	17	19½	15	20½	23	32
August	19	23	20	23	17	19	15	20½	24	34
September	19	24	23	24	18	21	15	21½	25	37
October	20	27	23	28½	21	23½	15	24	25	50
November	23	30½	29	31½	23½	27	15	30	25	55
December	26½	36½	28	35	25½	31	15	34	30	53
Year	17½	36½	17	37	16	40	14	34	19	55
1910.										
January	31	38	32½	40	28½	35	15	26	32	50
February	23½	31	23	30	22	26½	15	28	27	40
March	18½	24½	19½	22½	19	23	12	22	22	30
April	19½	22	19½	20½	19	20¼	15	19	23	26
May	17½	20½	18	20	17	19¼	13	18½	23	27
June	17½	19½	19	19¼	14½	17½	12	17½	22	28
July	15	19½	17	19	15	17½	10	17½	23	33
August	15	22	18½	22½	17½	21	10	20	25	33
September	20	24	23½	24	21	23	10	23	25	40
October	23	27	25	29	21½	24	12	25	30	48
November	26	31	30	34½	24	27½	14	30	35	55
December	28	33	36	38	27	29½	15	30	36	55
Year	15	38	17	40	14½	35	10	30	22	55
1911.										
January	18	32	18½	39	19	28	20	30	30	48
February	13	24	15	21	14½	20	15	24	19	36
March	13½	18	14½	17	13½	16¼	13	17	17	28
April	13	17	14½	15½	13¼	15¼	13	15½	17	21
May	13	16½	13	15	12	15	12½	15	18	22
June	12	15	12½	16	11	13	11	13½	18	25
July	12	17	14½	16	12	15	12	16	19	30
August	13	18	16	19½	13½	17	14½	16	20	31
September	13½	20½	20½	22½	15½	18	14½	19	24	35
October	17	23	21½	28	18½	21	18	23	27	50
November	20	28	29½	38	21	29	20	30	30	57
December	22	30	30	38	24	29	26	32	35	60
Year	12	32	12½	39	11	29	11	32	17	60

CHEESE.

International trade in cheese, 1906–1910.[1]

EXPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Bulgaria	Jan. 1	6,606,741	5,674,170	5,598,139	5,218,136	7,091,202
Canada	Jan. 1	213,316,430	189,381,875	172,081,891	177,259,042	186,665,789
France	Jan. 1	22,058,487	25,584,535	24,272,447	26,103,125	29,961,616
Germany [2]	Jan. 1	2,629,673	2,891,803	3,387,843	2,381,409	1,858,257
Italy	Jan. 1	42,314,633	46,607,032	43,711,481	44,054,742	57,436,885
Netherlands	Jan. 1	104,742,665	113,648,000	118,253,711	124,070,366	122,771,456
New Zealand	Jan. 1	14,695,072	26,525,296	31,449,376	44,867,984	50,614,480
Russia	Jan. 1	1,796,576	1,468,094	3,758,259	4,817,773	[3] 5,330,249
Switzerland	Jan. 1	61,935,107	62,213,331	67,654,558	69,217,606	69,391,549
United States	Jan. 1	22,376,340	10,341,335	10,190,843	3,501,214	2,768,681
Other countries		8,359,652	8,335,667	8,295,000	8,545,000	[3] 9,587,000
Total		500,831,376	492,671,138	488,653,548	510,036,397	543,477,164

IMPORTS.

Country.	Year beginning—	1906	1907	1908	1909	1910
Argentina	Jan. 1	7,304,669	7,304,669	8,085,698	8,884,664	9,535,944
Australia	Jan. 1	304,951	299,711	566,808	367,504	303,155
Austria-Hungary	Jan. 1	8,950,545	9,118,758	9,748,838	10,483,755	12,536,899
Belgium	Jan. 1	30,333,690	32,278,995	31,051,362	30,523,564	31,494,724
Brazil	Jan. 1	3,784,774	3,632,090	3,455,121	3,241,214	[4] 3,241,214
British South Africa	Jan. 1	5,752,252	4,761,140	4,459,453	4,329,228	4,726,520
Cuba	Jan. 1	4,078,517	5,232,438	4,147,120	4,106,493	4,807,741
Denmark	Jan. 1	1,782,437	1,784,642	1,686,536	1,739,429	1,357,813
Egypt	Jan. 1	10,064,909	8,650,855	9,072,778	8,947,118	9,229,798
France	Jan. 1	44,714,972	46,137,701	50,011,189	47,420,285	48,991,724
Germany [2]	Jan. 1	48,187,525	44,760,881	45,689,689	46,292,191	46,011,104
Italy	Jan. 1	10,398,982	10,294,042	16,953,323	17,438,827	14,760,899
Russia	Jan. 1	3,179,913	3,463,940	3,437,180	3,476,651	[3] 3,618,503
Spain	Jan. 1	4,255,835	4,398,856	4,531,113	4,422,370	4,882,058
Switzerland	Jan. 1	5,541,979	7,048,617	6,564,703	6,041,045	6,308,683
United Kingdom	Jan. 1	289,371,824	259,833,392	251,908,608	261,227,232	267,878,240
United States	Jan. 1	29,975,017	34,238,459	33,793,726	37,795,506	43,966,873
Other countries		21,271,863	20,753,857	19,751,000	22,321,000	[3] 22,500,000
Total		529,254,654	503,993,043	504,914,245	519,058,076	536,151,892

[1] See "General note," p. 526.
[2] Not including free ports prior to Mar. 1, 1906.
[3] Preliminary.
[4] Year preceding.

SHEEP AND WOOL.

Number, price per head, and farm value of sheep on farms in the United States, 1867–1912.

Year.	Number.	Price per head Jan. 1.	Farm value Jan. 1.	Year.	Number.	Price per head Jan. 1.	Farm value Jan. 1.
1867	39,385,000	$2.50	$98,644,000	1890	44,336,000	$2.27	$100,660,000
1868	38,992,000	1.82	71,053,000	1891	43,431,000	2.50	108,397,000
1869	37,724,000	1.64	62,037,000	1892	44,938,000	2.58	116,121,000
1870	40,853,000	1.96	79,876,000	1893	47,274,000	2.66	125,909,000
1871	31,851,000	2.14	68,310,000	1894	45,048,000	1.98	89,186,000
1872	31,679,000	2.61	82,768,000	1895	42,294,000	1.58	66,686,000
1873	33,002,000	2.71	89,427,000	1896	38,299,000	1.70	65,168,000
1874	33,938,000	2.43	82,353,000	1897	36,819,000	1.82	67,021,000
1875	33,784,000	2.55	86,278,000	1898	37,657,000	2.46	92,721,000
1876	35,935,000	2.37	85,121,000	1899	39,114,000	2.75	107,698,000
1877	35,804,000	2.13	76,362,000	1900	41,883,000	2.93	122,666,000
1878	35,740,000	2.21	78,898,000	1901	59,757,000	2.98	178,072,000
1879	38,124,000	2.07	78,965,000	1902	62,039,000	2.65	164,446,000
1880	40,766,000	2.21	90,231,000	1903	63,965,000	2.63	168,316,000
1881	43,570,000	2.39	104,071,000	1904	51,630,000	2.59	133,530,000
1882	45,016,000	2.37	106,596,000	1905	45,170,000	2.82	127,332,000
1883	49,237,000	2.53	124,366,000	1906	50,632,000	3.54	179,056,000
1884	50,627,000	2.37	119,903,000	1907	53,240,000	3.84	204,210,000
1885	50,360,000	2.14	107,961,000	1908	54,631,000	3.88	211,736,000
1886	48,322,000	1.91	92,444,000	1909	56,084,000	3.43	192,632,000
1887	44,759,000	2.01	89,873,000	1910	57,216,000	4.08	233,664,000
1888	43,545,000	2.05	89,280,000	1911	53,633,000	3.91	209,535,000
1889	42,599,000	2.13	90,640,000	1912	52,362,000	3.46	181,170,000

SHEEP AND WOOL—Continued.

Imports, exports, and average prices of sheep, 1892–1911.

Year ending June 30—	Imports.			Exports.		
	Number.	Value.	Average import price.	Number.	Value.	Average export price.
1892	380,814	$1,440,530	$3.78	46,960	$161,105	$3.43
1893	459,484	1,682,977	3.66	37,260	126,394	3.39
1894	242,568	788,181	3.25	132,370	832,763	6.29
1895	291,461	682,618	2.34	405,748	2,630,686	6.48
1896	322,692	853,530	2.65	491,565	3,076,384	6.26
1897	405,633	1,019,668	2.51	244,120	1,531,645	6.27
1898	392,314	1,106,322	2.82	199,690	1,213,886	6.08
1899	345,911	1,200,081	3.47	143,286	853,555	5.96
1900	381,792	1,365,026	3.58	125,772	733,477	5.83
1901	331,488	1,236,277	3.73	297,925	1,933,000	6.49
1902	266,953	956,710	3.58	358,720	1,940,060	5.41
1903	301,623	1,036,934	3.44	176,961	1,067,860	6.03
1904	238,094	815,289	3.42	301,313	1,954,604	6.49
1905	186,942	704,721	3.77	268,365	1,687,321	6.29
1906	240,747	1,020,359	4.24	142,690	804,090	5.64
1907	224,798	1,120,425	4.98	135,344	750,242	5.54
1908	224,765	1,082,606	4.82	101,000	589,285	5.83
1909	102,663	502,640	4.90	67,656	365,155	5.40
1910	126,152	696,879	5.52	44,517	209,000	4.69
1911	53,465	377,625	7.06	121,491	636,272	5.24

Number, average price per head, and farm value of sheep on farms in the United States, Jan. 1, 1912 and 1911.

State and Division.	Number Jan. 1.[1]		Average farm price per head Jan. 1.		Farm value Jan. 1.[1]	
	1912	1911	1912	1911	1912	1911
Maine	186	198	$4.10	$4.17	$763	$826
New Hampshire	43	45	4.30	4.48	185	202
Vermont	117	119	4.30	4.77	503	568
Massachusetts	35	35	4.80	5.42	168	190
Rhode Island	7	7	4.60	4.83	32	34
Connecticut	21	22	4.60	5.81	97	128
New York	911	930	4.40	5.38	4,008	5,003
New Jersey	30	31	5.20	5.51	156	171
Pennsylvania	883	901	4.30	4.84	3,797	4,361
North Atlantic	2,233	2,288	4.35	5.02	9,709	11,483
Delaware	8	8	4.30	4.52	34	36
Maryland	230	237	4.40	4.95	1,012	1,173
Virginia	781	805	3.60	4.32	2,812	3,478
West Virginia	838	901	3.90	4.48	3,268	4,036
North Carolina	193	203	2.80	2.98	540	605
South Carolina	34	34	2.80	2.80	95	95
Georgia	174	179	2.00	2.25	348	403
Florida	120	119	2.10	1.99	252	237
South Atlantic	2,378	2,486	3.52	4.05	8,361	10,063
Ohio	3,694	4,104	3.40	4.27	12,560	17,524
Indiana	1,372	1,444	4.20	5.09	5,762	7,350
Illinois	1,068	1,124	4.40	5.17	4,699	5,811
Michigan	2,276	2,421	3.60	4.61	8,194	11,161
Wisconsin	847	856	3.90	4.47	3,303	3,826
North Central East of Mississippi River	9,257	9,949	3.73	4.59	34,518	45,672

[1] Expressed in thousands; 000 omitted.

SHEEP AND WOOL—Continued.

Number, average price per head, and farm value of sheep on farms in the United States, Jan. 1, 1912 and 1911—Continued.

State and Division.	Number Jan. 1.[1]		Average farm price per head Jan. 1.		Farm value Jan. 1.[1]	
	1912	1911	1912	1911	1912	1911
Minnesota	600	625	$3.60	$3.96	$2,160	$2,475
Iowa	1,201	1,226	4.30	5.07	5,164	6,216
Missouri	1,755	1,847	3.80	4.34	6,669	8,016
North Dakota	287	293	3.60	3.84	1,033	1,125
South Dakota	605	672	3.30	3.83	1,996	2,574
Nebraska	382	382	3.60	4.07	1,375	1,555
Kansas	326	326	3.80	4.15	1,239	1,353
North Central West of Mississippi River	5,156	5,371	3.81	4.34	19,636	23,314
Kentucky	1,320	1,404	3.70	4.11	4,884	5,770
Tennessee	762	811	3.00	3.52	2,286	2,855
Alabama	140	146	2.20	2.32	308	339
Mississippi	214	214	2.20	2.30	471	492
Louisiana	176	178	2.00	1.81	352	322
Texas	2,032	1,954	2.80	2.83	5,690	5,530
Oklahoma	72	71	3.30	3.60	238	257
Arkansas	134	141	2.30	2.43	308	343
South Central	4,850	4,919	3.00	3.23	14,537	15,908
Montana	5,011	5,220	3.30	3.44	16,536	17,957
Wyoming	4,969	5,019	2.80	3.46	13,913	17,366
Colorado	1,579	1,611	3.00	3.60	4,737	5,800
New Mexico	3,300	3,113	2.80	3.12	9,240	9,713
Arizona	1,510	1,411	4.30	3.54	6,493	4,995
Utah	1,990	2,010	3.80	3.79	7,562	7,618
Nevada	1,444	1,444	3.80	4.02	5,487	5,805
Idaho	2,951	2,951	3.60	3.96	10,624	11,686
Washington	486	486	3.50	4.27	1,701	2,075
Oregon	2,592	2,672	3.30	3.91	8,554	10,448
California	2,656	2,683	3.60	3.59	9,562	9,632
Far Western	28,488	28,620	3.31	3.60	94,409	103,095
United States	52,362	53,633	3.46	3.91	181,170	209,535

Wholesale prices of sheep per 100 pounds, 1898–1911.

Date.	Chicago.		Cincinnati.		St. Louis.		Kansas City.	
	Inferior to choice.		Good to extra.		Good to choice natives.		Native.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1898	$2.50	$5.25	$3.10	$4.75	$3.00	$5.00	$2.00	$5.25
1899	2.50	5.65	3.00	5.00	3.00	5.60	2.25	5.85
1900	2.00	6.50	1.25	6.00	3.40	6.25	2.75	6.50
1901	2.50	5.15	2.10	5.00	3.00	5.10	1.50	5.00
1902	1.25	6.50	2.50	5.75	3.65	6.35	2.00	6.50
1903	1.25	7.00	2.60	6.25	3.50	6.25	2.25	6.80
1904	1.50	6.00	2.75	4.60	3.75	5.65	2.00	6.00
1905	3.80	6.30	3.60	5.50	4.60	6.35	2.75	6.90
1906	3.00	7.00	3.85	5.75	5.00	6.45	2.50	6.75
1907	2.00	7.25	3.65	5.90	4.25	7.00	2.25	7.75
1908.								
January	2.50	5.75	4.25	5.00	5.00	5.50	2.50	6.10
February	2.50	5.75	4.50	5.25	4.25	6.35	3.00	6.10
March	3.25	7.00	4.65	5.50	5.25	6.50	3.00	7.15
April	3.00	7.00	4.50	5.25	6.50	6.90	3.00	6.50
May	2.00	6.75	4.10	5.00	4.75	5.90	3.25	5.60
June	2.50	5.60	3.60	4.50	5.00	5.50	2.50	5.25
July	2.50	5.25	3.00	3.85	4.40	4.50	2.00	5.50
August	2.25	5.50	3.25	4.00	4.25	4.65	2.00	4.75

SHEEP AND WOOL—Continued.

Wholesale prices of sheep per 100 pounds, 1898–1911—Continued.

Date.	Chicago.		Cincinnati.		St. Louis.		Kansas City.	
	Inferior to choice.		Good to extra.		Good to choice natives.		Native.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1908.								
September	$2.00	$5.15	$2.75	$3.75	$4.15	$4.35	$1.75	$4.35
October	2.00	5.25	3.00	3.75	4.10	4.65	1.50	4.65
November	2.00	5.50	3.00	3.75	4.50	4.65	1.50	5.30
December	2.00	5.50	3.25	4.25	4.50	4.75	2.00	7.15
Year	2.00	7.00	2.75	5.50	4.10	6.90	1.50	7.15
1909.								
January	2.50	5.50	3.50	5.25	4.25	6.00	2.50	6.75
February	2.00	5.50	4.50	5.25	5.40	6.25	2.00	7.00
March	3.00	5.75	4.50	5.75	5.50	6.50	2.00	7.10
April	3.50	6.50	4.75	5.75	6.15	6.50	3.00	7.65
May	3.00	6.90	4.35	5.25	6.35	6.65	3.50	7.50
June	2.50	6.75	3.50	5.25	5.25	6.50	4.00	8.00
July	2.50	5.50	3.35	4.50	4.25	5.00	2.25	5.50
August	2.00	5.00	3.75	4.50	4.50	5.00	2.25	5.50
September	2.00	5.25	3.50	4.50	4.50	5.00	2.00	5.25
October	2.00	5.00	3.35	4.25	4.75	5.00	2.00	5.15
November	2.00	5.50	3.60	4.50	4.35	5.00	3.25	7.00
December	2.50	6.00	3.75	5.50	5.15	6.25	3.50	7.25
Year	2.00	6.90	3.35	5.75	4.25	6.65	2.00	8.00
1910.								
January	3.25	6.30	4.75	6.00	6.00	6.30	4.00	7.65
February	4.00	7.90	5.25	6.50	6.10	7.25	5.50	8.25
March	5.00	9.30	6.00	6.75	7.00	8.50	6.00	9.50
April	4.00	8.40	6.00	7.00	8.00	8.75	6.00	9.00
May	4.25	7.65	4.50	6.50	5.75	8.30	4.50	8.00
June	3.75	6.25	3.60	5.25	5.00	6.00	4.00	7.15
July	2.50	5.00	3.00	4.25	4.25	4.60	3.85	6.50
August	3.00	4.65	3.25	4.25	4.25	4.50	3.00	5.50
September	3.00	4.65	3.25	4.25	4.35	4.75	3.50	6.25
October	2.75	4.45	3.15	4.25	4.25	4.50	3.25	6.00
November	2.00	4.50	3.00	4.15	3.75	4.20	2.00	5.25
December	2.85	4.50	3.25	4.00	4.10	4.25	2.55	5.75
Year	2.00	9.30	3.00	7.00	3.75	8.75	2.00	9.50
1911.	[1]							
January	2.50	6.65	3.50	4.50	4.25	4.50	2.50	5.75
February	2.50	6.50	3.25	4.25	4.15	4.75	2.50	4.75
March	3.25	6.65	3.75	5.15	4.65	5.00	4.00	5.10
April	3.00	6.60	3.35	4.50	4.05	5.00	4.00	5.00
May	2.75	7.85	3.25	4.00	4.35	4.85	3.00	6.25
June	2.00	7.40	2.55	4.00	3.50	4.90	2.50	5.00
July	2.00	7.55	2.75	3.50	3.75	4.20	2.50	5.25
August	2.00	7.40	2.50	3.50	3.50	4.50	2.00	4.50
September	2.25	6.40	2.50	3.50	3.65	4.00	2.00	4.40
October	1.75	6.40	2.50	3.50	4.00	4.25	2.25	5.00
November	1.50	6.50	2.40	3.25	4.00	4.15	1.50	4.25
December	1.75	6.40	2.50	3.50	4.00	4.50	1.75	4.50
Year	1.50	7.85	2.40	5.15	3.50	5.00	1.50	6.25

[1] Includes yearlings and lambs.

SHEEP AND WOOL—Continued.

Wool product of the United States.

[Estimates of National Association of Wool Manufacturers.]

State and year.	Number of sheep of shearing age Apr. 1.	Average weight of fleece.	Per cent of shrinkage.	Wool washed and unwashed.[1]	Wool scoured.[1]
	Number.	*Pounds.*	*Per cent.*	*Pounds.*	*Pounds.*
Maine	150,000	6.00	42	900,000	522,000
New Hampshire	33,000	6.00	48	198,000	102,960
Vermont	90,000	6.50	50	585,000	292,500
Massachusetts	23,000	6.25	42	143,750	83,375
Rhode Island	5,000	6.00	42	30,000	17,400
Connecticut	15,000	5.50	42	82,500	47,850
New York	650,000	6.20	49	4,030,000	2,055,300
New Jersey	17,000	5.50	47	93,500	49,555
Pennsylvania	650,000	6.50	48	4,225,000	2,197,000
Delaware	5,000	5.50	45	27,500	15,125
Maryland	128,000	5.80	45	742,400	408,320
Virginia	450,000	4.50	36	2,025,000	1,296,000
West Virginia	600,000	5.75	49	3,450,000	1,759,500
North Carolina	150,000	3.75	42	562,500	326,250
South Carolina	30,000	3.75	42	112,500	65,250
Georgia	175,000	4.00	44	700,000	392,000
Florida	100,000	3.25	40	325,000	195,000
Ohio	2,900,000	6.50	50	18,850,000	9,425,000
Indiana	700,000	6.50	46	5,525,000	2,983,500
Illinois	850,000	7.00	48	4,900,000	2,548,000
Michigan	1,600,000	6.80	50	10,880,000	5,440,000
Wisconsin	650,000	6.75	47	4,387,500	2,325,375
Minnesota	480,000	7.00	48	3,360,000	1,747,200
Iowa	900,000	6.75	48	6,075,000	3,159,500
Missouri	1,150,000	7.00	47	8,050,000	4,266,500
North Dakota	250,000	7.25	63	1,812,500	670,625
South Dakota	525,000	6.75	60	3,543,750	1,417,500
Nebraska	250,000	6.50	63	1,625,000	601,250
Kansas	225,000	7.50	65	1,687,500	590,625
Kentucky	800,000	4.75	38	3,800,000	2,356,000
Tennessee	500,000	4.25	40	2,162,500	1,297,500
Alabama	120,000	3.25	40	390,000	234,000
Mississippi	160,000	4.00	42	640,000	371,200
Louisiana	145,000	3.70	41	536,500	316,535
Texas	1,400,000	6.75	67	9,450,000	3,118,500
Oklahoma	60,000	6.50	70	390,000	117,000
Arkansas	100,000	4.00	40	400,000	240,000
Montana	4,650,000	7.50	64	34,875,000	12,903,750
Wyoming	4,000,000	8.50	70	34,000,000	10,200,000
Colorado	1,300,000	7.00	68	9,100,000	2,912,000
New Mexico	3,000,000	7.00	66	20,250,000	6,885,000
Arizona	850,000	6.75	67	5,950,000	1,963,500
Utah	2,000,000	6.75	66	13,500,000	4,590,000
Nevada	825,000	7.00	67	5,775,000	1,905,750
Idaho	2,200,000	7.50	65	16,500,000	5,775,000
Washington	400,000	9.25	70	3,700,000	1,110,000
Oregon	1,800,000	8.50	69	15,300,000	4,743,000
California	1,700,000	7.00	67	11,900,000	3,927,000
United States, 1911	39,761,000	6.98	60.4	318,547,900	139,896,195
1910	41,999,500	6.70	60	321,362,750	141,805,813
1909	42,293,205	6.80	60.9	328,110,749	142,223,785
1908	40,311,548	6.70	60.5	311,138,321	135,330,648
1907	38,864,931	6.60	60.6	298,294,750	130,359,118
1906	38,540,798	6.66	61.1	298,915,130	129,410,942
1905	38,621,476	6.56	61.3	295,488,438	126,527,121
1904	38,342,072	6.50	61.6	291,783,032	123,935,147
1903	39,284,000	6.25	6.08	287,450,000	124,366,405
1902	42,184,122	6.50	6	316,346,032	137,912,085
1901	41,920,900	6.33	6.06	302,502,328	126,814,690
1900	40,267,818	6.46	6.11	288,636,621	118,223,120
1899	36,905,497	6.46	60.7	272,191,330	113,958,468

[1] Totals include pulled wool.

SHEEP AND WOOL—Continued.

Range of prices of wool per pound in Boston, 1898–1911.[1]

Date.	Ohio fine, unwashed.		Indiana quarter-blood, unwashed.		Ohio XX, washed.		Ohio No. 1, washed.		Ohio Delaine, washed.		Michigan fine, unwashed.[2]		Fine selected Territory, staple scoured.		Fine medium Territory, clothing scoured.		Texas, 12 months, scoured.		Fine free fall, Texas or California, scoured.		Pulled, A super, scoured.		Pulled, B super, scoured	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
1898	18	21	20	24	27	30	29	31	28	32	21	25	46	57	42	52	42	53	35	45	40	48	32	43
1899	16	26	20	28	25½	38	28½	39	27	40	20	30	42	75	38	62	40	65	30	52	40	57	30	52
1900	18	26	23	29	27	38	28	39	27½	40	21½	29	49	74	45	62	48	65	40	55	42	57	37	50
1901	16½	19½	19½	24	26	28	25	29	27½	30	20	22	43	50	35	44	43	50	36	42	35	45	30	38
1902	19	23	20½	24	27	32	26	31	28	35	21	27	48	59	42	50	48	60	38	48	38	46	33	40
1903	20	25	22	25	30	35	29	34	33½	37	21	27½	52	60	50	58	53	60	44	48	40	47	39	44
1904	21	25	24	33	32	36	30	40	34	38	19	22	50	70	50	68	52	68	44	56	43	60	40	55
1905	23	30	30	37	34	37	36	43	36	40	20	27	65	78	60	72	63	76	54	63	55	65	52	60
1906	24	28	30	34	33½	36	37	41	35½	37½	24	26½	70	78	65	70	72	76	58	63	53	69	47	56
1907	25	28	29	34	33	35	38	41	36	39	23	26	70	75	66	73	70	75	50	62	45	60	38	52
1908.																								
January	26	27	28	30	34	35	38	40	38	39	24	25	70	72	58	62	70	72	50	53	46	55	38	45
February	24	27	26	30	33	34	37	39	37	38	22	25	65	70	53	57	68	70	48	52	45	48	35	40
March	24	26	25	28	33	34	37	38	37	38	22	24	63	68	53	55	63	65	48	50	44	48	35	40
April	22	25	23	26	32	34	35	38	35	37	21	23	58	65	48	55	56	65	43	48	44	48	35	40
May	19	21	20	24	30	32	31	35	31	34	18	20	54	60	43	48	50	56	42	45	44	48	32	38
June	19	20	20	24	30	32	31	32	31	34	18	20	53	57	43	48	50	52	42	43	44	45	32	37
July	21	23	23	25	32	33	32	35	33	36	20	22	55	60	45	48	50	55	42	43	44	46	32	38
August	20	23	24	25	32	33	34	35	35	36	20	22	57	60	45	48	52	53	42	43	43	45	35	38
September	20	22	23	24	32	33	34	35	34	36	19	21	57	58	43	45	50	53	42	43	42	45	35	38
October	21	22	23	25	32	33	34	35	34	35	20	21	57	60	45	50	50	54	42	43	42	48	35	40
November	21	22	24	27	32½	33	34	35	34	36	20	21	57	63	47	52	51	60	42	50	43	50	36	45
December	21	24	25	27	32½	35	34	39	35	37	20	22	62	65	49	52	60	62	45	47	47	55	39	45
Year	19	27	20	30	30	35	31	40	31	39	18	25	53	72	43	62	50	72	42	53	42	55	32	45
1909.																								
January	23	24	27	28	34	35	38	39	37	40	22	23	62	65	60	62	60	65	48	50	47	55	38	48
February	23	24	27	29	34	35	38	39	38	40	22	23	62	65	60	62	62	65	48	50	50	55	40	48
March	23	24	27	29	34	35	38	39	38	40	22	23	63	65	60	62	62	65	48	50	50	55	40	48
April	23	24	27	29	34	35	38	39	39	40	22	23	63	65	60	62	62	65	45	47	50	56	40	48
May	23	28	28	37	34	35	38	40	39	42	23	25	63	77	60	72	62	67	45	55	55	60	46	53
June	27	28	36	37	35	36	40	41	40	42	25	26	74	78	69	72	70	72	58	60	55	62	48	53
July	27	28	32	37	35	36	40	41	40	42	25	26	74	78	69	72	70	75	58	60	55	62	48	53

August	27	28	32	33	35	36	40	41	39	40	25	26	75	80	69	72	73	78	58	60	55	62	48	55
September	27	28	32	33	35	37	40	41	39	41	25	26	77	80	70	72	75	78	58	60	55	63	50	58
October	27	28	32	33	36	37	40	41	40	41	25	26	77	80	70	72	75	78	58	60	60	64	52	58
November	27	28	32	33	37	38	40	41	39	41	25	26	77	80	70	72	75	78	58	60	60	64	52	58
December	27	28	32	33	37	38	40	41	39	40	25	26	77	80	70	72	73	78	58	62	60	65	52	58
Year	23	28	27	37	34	38	38	41	37	42	22	26	62	80	60	72	60	78	45	62	47	65	38	58
1910.																								
January	27	28	32	33	37	38	40 [3]	41	39	40	25	26	75	80	64	68	73	75	60 [4]	62	60	65	52	58
February	27	28	32	36	37	38	40	41	39	40	25	26	75	76	64	68	70	75	60	62	60	65	52	58
March	25	28	34	36	36	38	40	41	37	40	24	26	70	75	63	68	68	71	60	62	60	65	52	58
April	23	26	29	35	33	37	36	41	35	38	22	25	63	72	57	65	65	70	52	60	57	63	48	58
May	23	24	28	30	33	34	36	37	35	35	22	23	63	66	55	58	60	67	52	54	56	58	48	54
June	20	24	26	28	32	34	36	37	34	35	22	23	63	65	56	58	60	61	52	54	56	58	48	52
July	20	21	24	26	30	32	27	29	34	34	19	20	60	64	54	56	55	60	48	52	56	57	45	51
August	20	21	24	28	30	30	28	29	34	34	19	20	60	65	55	57	55	60	48	50	56	62	45	48
September	20	23	27	28	30	30	28	29	34	34	19	21	64	65	55	58	57	62	50	50	56	57	45	48
October	21	23	27	28	30	30	28	30	34	34	19	21	64	65	55	56	57	60	50	50	52	57	45	48
November	22	24	27	28	30	32	29	30	34	34	19	21	64	66	55	56	58	60	48	50	50	55	45	52
December	22	24	27	28	31	32	29	30	34	35	20	21	63	65	55	56	58	60	48	50	53	55	47	52
Year	20	28	24	36	30	38	27	41	34	40	19	26	60	80	54	68	55	75	48	62	50	65	45	58
1911.																								
January	22	22	26	27	31½	32	29	30	34	34	20	21	60	62	58	59	57	60	48	50	53	55	43	47
February	22	22	26	27	31½	32	29	30	34	34	20	21	60	62	58	59	54	59	45	50	53	55	42	45
March	21	22	25	25½	31	32	27	30	33	34	20	21	57	58	55	57	48	55	43	45	47	53	42	43
April	18	20½	23	24	28	29	26	27	30	32	17	20	53	56	51	53	47	50	41	43	46	47	41	42
May	18	20	22½	23	27	29	25	27	29	30	17	17½	55	57	52	55	46	48	41	42	45	48	41	42
June	18	19½	22½	23½	27	28	25	25	30	30	17	18	55	58	53	56	46	51	41	43	45	48	41	42
July	19½	21	23	24	27	28	25	26	29	30	18	19	55	59	53	57	52	53	42	43	46	48	41	44
August	21	22	24	25	28	29	25	26	30	31	19	21	60	62	58	60	52	55	42	45	46	48	42	45
September	20	21	24	24½	28	28	25	26½	30	30	19	20	60	62	58	59	53	55	43	45	46	48	42	45
October	21	21	23½	24	28	28	25	26	30	31	19	20	57	60	56	57	51	55	42	45	45	46	42	44
November	21	21	23	24	28	28	25½	26	30	31	19	20	58	60	56	59	51	53	42	44	45	46	42	44
December	21	21	24	25	28	28	26	26	31	32	19	20	60	62	58	60	52	53	42	43	45	46	42	44
Year	18	22	22½	27	27	32	25	30	29	34	17	21	53	62	51	60	46	60	41	50	45	55	41	47

[1] From Commercial Bulletin, Boston.
[2] Quoted as X, washed, to June, 1903.
[3] From July, 1910, quotations are for Ohio half blood, unwashed, approximately 7 cents lower than Ohio No. 1.
[4] Excluding California.

SHEEP AND WOOL—Continued.

Wholesale prices of wool per pound, 1898–1911.

Date.	Boston. Ohio XX, washed. Low.	Boston. Ohio XX, washed. High.	Philadelphia. Ohio XX, washed. Low.	Philadelphia. Ohio XX, washed. High.	St. Louis. Best tub-washed. Low.	St. Louis. Best tub-washed. High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1898	27	30	28	31	25½	30
1899	25½	38	25½	36	25½	35
1900	27	38	27	37	28	36
1901	26	28	25	28	24	29½
1902	27	32	26	32	24	29
1903	30	35	30	34	27	31
1904	32	36	31½	33½	30½	41
1905	34	37	34	36	37	43
1906	33½	36	33	35	31	40
1907	33	35	33	34	33	38
1908.						
January	34	35	33	34	33	33
February	33	34	33	33½	33	33
March	33	34	32½	33	30	33
April	32	34	32	32½	24	30
May	30	32	31	32	22	25
June	30	32	30	31	25	27½
July	32	33	31	32	27	27
August	32	33	32	33	27	27
September	32	33	32	33	26	27
October	32	33	32	33	26	27
November	32½	33	32	33	26	29
December	32½	35	33	33½	28	30
Year	30	35	30	34	22	33
1909.						
January	34	35	32	33	30	31
February	34	35	32	33	31	32
March	34	35	32	33	31	32
April	34	35	33	34	31	32
May	34	35	34	35	32	38
June	35	36	34	35	36	38
July	35	36	34	35	36	36½
August	35	36	34	35	36	37½
September	35	37	34	35	37	37½
October	36	37	34	35	37	38
November	37	38	34	35	38	38
December	37	38	34	35	37	38
Year	34	38	32	35	30	38
1910.						
January	37	38	34	35	37	37
February	37	38	34	35	37	37
March	36	38	34	35	36	37
April	33	37	33	35	36	36
May	33	34	32	34	33	36
June	32	34	31	33	31	33
July	30	32	30	32	32	33
August	30	30	30	31	33	33
September	30	30	30	31	33	33
October	30	30	30	31	33	33
November	30	32	30	31	33	33
December	31	32	30	31	33	33
Year	30	38	30	35	31	37
1911.						
January	31½	32	30	31	33	33
February	31½	32	30	31	33	33
March	31	32	30	31	31	33
April	28	29	29	30	28	30
May	27	29	27½	29	28	31
June	27	28	27½	28	30	31
July	27	28	27½	28	30	30
August	28	29	27½	28	30	30
September	28	28	27	28	31	31
October	28	28	27	28	30	31
November	28	28	27	28	30	30
December	28	28	27	28	30	30
Year	27	32	27	31	28	33

SHEEP AND WOOL—Continued.

International trade in wool, 1906–1910.[1]

EXPORTS.

Country.	Year beginning.	1906	1907	1908	1909	1910
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Algeria	Jan. 1	26,962,307	26,624,118	16,233,514	[2] 27,224,960	[2] 22,124,480
Argentina	Jan. 1	328,731,186	341,297,532	386,994,937	389,512,862	332,010,555
Australia	Jan. 1	523,026,207	637,836,589	598,032,199	641,157,751	708,644,403
Belgium	Jan. 1	40,098,225	40,778,437	40,465,085	40,651,742	241,457,748
British India	Jan. 1	44,870,964	44,194,774	32,108,670	63,052,315	54,458,894
British South Africa	Jan. 1	104,516,265	116,472,023	122,443,992	150,630,571	139,488,573
Chile	Jan. 1	28,978,611	31,762,088	32,430,184	29,340,964	27,749,867
China	Jan. 1	46,205,733	39,429,333	33,441,467	50,057,733	31,091,867
France	Jan. 1	79,399,693	84,639,488	72,337,175	91,793,812	82,685,948
Netherlands	Jan. 1	27,585,904	20,296,466	26,359,444	27,520,247	20,836,188
New Zealand	Jan. 1	159,849,207	177,535,594	168,035,607	198,021,725	[2] 204,368,957
Peru	Jan. 1	10,066,289	8,393,192	6,743,297	8,375,328	[3] 8,375,328
Russia	Jan. 1	41,919,341	30,351,617	14,409,079	29,629,433	[2] 20,826,252
Spain	Jan. 1	26,552,450	32,203,800	14,373,068	36,906,860	23,935,503
Turkey [4]	Mar. 14	40,156,583	40,156,583	40,156,583	40,156,583	40,156,583
United Kingdom	Jan. 1	29,808,700	31,148,692	38,311,090	62,941,681	38,185,983
Uruguay	July 1	90,743,833	99,840,335	84,129,000	[5] 128,708,080	[5] 92,782,796
Other countries		105,659,951	85,230,391	77,213,000	100,090,000	[2] 100,171,000
Total		1,755,131,449	1,888,191,052	1,804,217,391	2,115,772,647	2,189,350,925

IMPORTS.

Country.	Year beginning.	1906	1907	1908	1909	1910
Austria-Hungary	Jan. 1	52,973,098	52,919,967	60,634,821	67,222,884	61,262,968
Belgium	Jan. 1	134,875,551	148,253,340	131,118,370	131,380,685	355,584,811
British India	Jan. 1	22,387,912	20,626,006	18,470,491	20,252,059	20,497,152
Canada	Jan. 1	5,164,318	6,406,325	4,468,680	8,235,570	6,435,074
France	Jan. 1	537,763,155	554,982,155	504,910,496	622,749,015	607,877,004
Germany [6]	Jan. 1	431,306,075	439,917,329	430,576,566	471,480,165	471,055,339
Japan	Jan. 1	13,413,886	22,684,732	9,416,601	7,754,818	9,843,913
Netherlands	Jan. 1	34,408,944	24,081,928	31,714,118	28,612,749	25,867,813
Russia	Jan. 1	69,585,429	78,494,890	71,353,043	94,975,797	[2] 82,951,102
Sweden	Jan. 1	10,807,835	5,751,347	7,184,385	5,856,083	5,736,464
Switzerland	Jan. 1	11,464,696	10,323,804	11,097,626	11,524,546	11,154,394
United Kingdom	Jan. 1	406,403,772	527,766,993	470,804,920	500,198,977	548,445,334
United States	Jan. 1	196,844,298	188,305,955	142,559,384	312,131,171	180,134,981
Other countries		44,973,075	44,401,449	48,431,000	54,445,000	[2] 60,894,000
Total		1,972,372,044	2,124,916,220	1,942,740,501	2,336,819,519	2,447,740,349

[1] See "General note," page 526.
[2] Preliminary.
[3] Year preceding.
[4] Data for 1905.
[5] Year beginning Jan. 1.
[6] Not including free ports prior to Mar. 1, 1906.

SWINE.

Number and farm value of swine on farms in the United States, 1867–1912.

January 1—	Number.	Price per head.	Farm value.	January 1—	Number.	Price per head.	Farm value.
1867	24,694,000	$4.03	$99,637,000	1890	51,603,000	$4.72	$243,418,000
1868	24,317,000	3.29	79,976,000	1891	50,625,000	4.15	210,194,000
1869	23,316,000	4.65	108,431,000	1892	52,398,000	4.60	241,031,000
1870	26,751,000	5.80	155,108,000	1893	46,095,000	6.41	295,426,000
1871	29,458,000	5.61	165,312,000	1894	45,206,000	5.98	270,385,000
1872	31,796,000	4.01	127,453,000	1895	44,166,000	4.97	219,501,000
1873	32,632,000	3.67	119,632,000	1896	42,843,000	4.35	186,530,000
1874	30,861,000	3.98	122,695,000	1897	40,600,000	4.10	166,273,000
1875	28,062,000	4.80	134,581,000	1898	39,760,000	4.39	174,351,000
1876	25,727,000	6.00	154,251,000	1899	38,652,000	4.40	170,110,000
1877	28,077,000	5.66	158,873,000	1900	37,079,000	5.00	185,472,000
1878	32,262,000	4.85	156,577,000	1901	56,982,000	6.20	353,012,000
1879	34,766,000	3.18	110,508,000	1902	48,699,000	7.03	342,121,000
1880	34,034,000	4.28	145,782,000	1903	46,923,000	7.78	364,974,000
1881	36,248,000	4.70	170,535,000	1904	47,009,000	6.15	289,225,000
1882	44,122,000	5.97	263,543,000	1905	47,321,000	5.99	283,255,000
1883	43,270,000	6.75	291,951,000	1906	52,103,000	6.18	321,803,000
1884	44,201,000	5.57	246,301,000	1907	54,794,000	7.62	417,791,000
1885	45,143,000	5.02	226,402,000	1908	56,084,000	6.05	339,030,000
1886	46,092,000	4.26	196,570,000	1909	54,147,000	6.55	354,794,000
1887	44,613,000	4.48	200,043,000	1910	47,782,000	9.14	436,603,000
1888	44,347,000	4.98	220,811,000	1911	65,620,000	9.37	615,170,000
1889	50,302,000	5.79	291,307,000	1912	65,410,000	8.00	523,328,000

SWINE—Continued.

Number, average farm price per head, and farm value of swine on farms in the United States, Jan. 1, 1912 and 1911.

State and Division.	Number Jan. 1.[1]		Average price per head Jan. 1.		Farm value Jan. 1.[1]	
	1912	1911	1912	1911	1912	1911
Maine	101	95	$11.50	$13.10	$1,162	$1,244
New Hampshire	53	51	10.50	11.70	556	597
Vermont	111	106	10.00	10.80	1,110	1,145
Massachusetts	117	115	11.30	12.20	1,322	1,403
Rhode Island	16	15	12.00	12.50	192	188
Connecticut	60	58	11.60	13.00	696	754
New York	777	733	10.20	11.60	7,925	8,503
New Jersey	165	162	11.30	13.00	1,864	2,106
Pennsylvania	1,141	1,066	10.00	11.50	11,410	12,259
North Atlantic	2,541	2,401	10.32	11.74	26,237	28,199
Delaware	59	54	7.20	9.50	425	513
Maryland	345	338	8.00	8.80	2,760	2,974
Virginia	880	854	6.30	7.50	5,544	6.405
West Virginia	363	367	6.70	7.50	2,432	2,752
North Carolina	1,405	1,351	7.40	7.60	10,397	10,268
South Carolina	797	745	8.00	8.30	6,376	6,184
Georgia	2,098	1,873	6.70	7.40	14,057	13,860
Florida	954	867	5.20	4.60	4,961	3,988
South Atlantic	6,901	6,449	6.80	7.28	46,952	46,944
Ohio	3,578	3,727	8.20	9.30	29,340	34,661
Indiana	4,031	4,156	7.70	9.30	31,039	38,651
Illinois	4,640	5,155	8.80	10.40	40,832	53,612
Michigan	1,382	1,396	8.50	10.50	11,747	14,658
Wisconsin	2,051	1,899	9.60	11.00	19,690	20,889
North Central East of Mississippi River.	15,682	16,333	8.52	9.95	132,648	162,471
Minnesota	1,702	1,702	10.40	11.10	17,701	18,892
Iowa	9,689	9,055	9.80	11.60	94,952	105,038
Missouri	4,491	4,882	7.00	8.60	31,437	41,985
North Dakota	359	352	10.50	10.40	3,770	3,661
South Dakota	1,104	1,162	8.90	11.00	9,826	12,782
Nebraska	4,267	3,951	8.80	10.90	37,550	43,066
Kansas	2,808	3,600	7.90	9.90	22,183	35,640
North Central West of Mississippi River.	24,420	24,704	8.90	10.57	217,419	261,064
Kentucky	1,724	1,626	5.40	7.20	9,310	11,707
Tennessee	1,574	1,499	6.10	7.40	9,601	11,093
Alabama	1,533	1,419	6.50	6.90	9,964	9,791
Mississippi	1,577	1,421	6.50	6.30	10,250	8,952
Louisiana	1,642	1,594	5.80	6.20	9,524	9,883
Texas	2,544	2,570	6.30	7.70	16,027	19,789
Oklahoma	1,410	1,931	5.50	8.30	7,755	16,027
Arkansas	1,738	1,671	5.40	5.90	9,385	9,859
South Central	13,742	13,731	5.95	7.07	81,816	97,101
Montana	143	124	9.90	10.40	1,416	1,290
Wyoming	43	41	8.60	11.00	370	451
Colorado	211	215	8.00	9.80	1,688	2,107
New Mexico	50	46	8.20	9.20	410	423
Arizona	22	18	10.50	9.60	231	173
Utah	79	72	9.00	9.80	711	706
Nevada	30	28	10.50	10.10	315	283
Idaho	212	196	8.00	9.20	1,696	1,803
Washington	246	237	9.50	10.50	2,337	2,488
Oregon	258	235	8.50	9.20	2,193	2,162
California	830	790	8.30	9.50	6,889	7,505
Far Western	2,124	2,002	8.60	9.69	18,256	19,391
United States	65,410	65,620	8.00	9.37	523,328	615,170

[1] Expressed in thousands; 000 omitted.

SWINE—Continued.

Wholesale prices of live hogs per 100 pounds, 1898–1911.

Date.	Cincinnati. Packing, fair to good.		St. Louis. Mixed packers.		Chicago.		Kansas City.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1898	$3.15	$4.45	$3.10	$4.55	$3.10	$4.80	$3.35	$4.65
1899	3.45	4.85	3.40	4.85	3.30	5.00	3.62½	4.80
1900	4.45	5.85	4.40	5.75	3.35	5.85	4.40	5.67½
1901	5.15	7.20	4.90	7.10	3.00	7.40	5.05	7.12½
1902	5.85	8.00	5.80	8.20	4.40	8.20	6.10	8.17½
1903	4.15	7.75	4.20	7.60	3.75	7.85	4.35	7.60
1904	4.35	6.25	4.25	6.30	3.60	6.37½	4.47½	6.07½
1905	4.60	6.35	4.75	6.35	3.90	6.45	4.55	6.25
1906	5.30	6.95	5.10	6.97	4.60	7.00	5.20	6.87½
1907	4.15	7.40	4.00	7.22	3.10	7.25	4.00	7.15
1908.								
January	4.15	4.70	4.20	4.62	3.95	4.72½	4.00	4.60
February	4.25	4.85	4.20	4.60	4.00	4.70	4.00	4.50
March	4.55	6.30	4.40	6.12	4.15	6.35	4.25	6.15
April	5.50	6.40	3.50	6.15	5.00	6.45	5.25	6.00
May	5.35	5.95	5.30	5.85	5.00	5.90	5.15	5.65
June	5.30	6.60	5.30	5.90	5.05	6.67½	5.05	6.15
July	6.35	7.10	5.90	6.90	5.60	7.10	5.85	6.75
August	6.10	7.15	6.25	6.90	5.60	7.10	6.15	6.90
September	6.00	7.35	6.40	7.35	6.05	7.60	6.35	7.15
October	4.85	7.00	5.10	7.15	4.70	7.20	4.90	6.70
November	5.10	6.20	5.40	6.05	4.65	6.40	5.20	6.10
December	5.25	6.25	5.30	5.90	4.60	6.15	4.80	5.95
Year	4.15	7.35	4.20	7.35	3.95	7.60	4.00	7.15
1909.								
January	5.75	6.75	5.75	6.60	5.20	[1] 6.70	5.25	6.40
February	6.15	7.10	6.05	6.75	5.75	6.95	5.70	6.50
March	6.30	7.30	6.10	7.05	5.95	7.15	6.00	6.90
April	6.80	7.55	6.75	7.45	6.50	7.60	6.00	7.30
May	7.05	7.55	6.95	7.40	6.75	7.55	6.00	7.45
June	7.05	8.15	7.10	8.00	6.80	8.20	6.85	7.90
July	7.40	8.40	7.60	8.20	7.00	8.45	7.20	8.05
August	7.75	8.30	7.60	8.10	6.95	8.25	7.40	8.00
September	7.60	8.45	7.70	8.40	7.20	8.60	7.65	8.30
October	7.25	8.15	7.25	8.05	6.85	8.40	7.00	8.10
November	7.55	8.25	7.70	8.40	7.20	8.45	7.40	8.20
December	7.95	8.80	7.80	8.65	7.65	8.75	7.90	8.50
Year	5.75	8.80	5.75	8.65	5.20	8.75	5.25	8.50
1910.								
January	8.00	9.00	7.70	8.85	7.75	9.05	7.90	8.65
February	8.25	9.85	8.00	9.65	8.05	10.00	8.15	9.55
March	9.75	11.10	9.50	10.95	9.45	11.20	9.35	10.90
April	9.00	11.05	8.85	11.05	8.75	11.00	8.70	10.75
May	9.25	9.90	9.15	9.75	9.05	9.80	8.95	9.60
June	9.10	9.70	9.22	9.67	9.10	9.80	9.05	9.60
July	8.45	9.40	8.40	9.60	8.30	9.60	8.00	9.30
August	8.35	9.60	8.00	9.35	8.20	9.70	7.65	9.55
September	8.85	10.15	8.60	9.95	8.65	10.10	8.50	9.80
October	8.65	9.35	8.25	9.37	8.25	9.65	8.00	9.35
November	6.95	8.60	6.80	8.80	6.50	8.70	6.90	8.55
December	7.25	8.20	7.00	8.05	6.80	8.10	7.20	7.85
Year	6.95	11.10	6.80	11.05	6.50	11.20	6.90	10.90
1911.								
January	7.85	8.25	7.55	8.22	7.30	8.30	7.55	8.05
February	7.25	7.90	7.00	7.97	6.60	7.90	6.80	7.70
March	6.75	7.50	6.50	7.25	6.10	7.35	6.35	7.10
April	6.15	6.90	5.85	7.15	5.65	6.90	5.85	6.65
May	5.85	6.50	5.80	6.35	5.35	6.50	5.72	6.15
June	5.90	6.65	5.85	6.65	5.55	6.72½	5.80	6.45
July	6.65	7.35	6.35	7.25	6.10	7.50	6.15	7.05
August	7.35	8.00	7.10	7.75	6.45	7.95	6.85	7.60
September	6.50	7.65	6.55	7.65	5.75	7.80	6.25	7.40
October	6.10	6.95	6.00	6.50	5.65	6.90	5.65	6.55
November	5.75	6.55	6.00	6.45	5.30	6.72½	5.60	5.60
December	5.90	6.45	5.90	6.45	5.40	6.60	5.60	6.35
Year	5.75	8.25	5.80	8.22	5.30	8.30	5.60	8.05

[1] Light to heavy.

CHICKENS.

Average price per pound received by farmers on first of months indicated.

State and Division.	1910						1911											
	Feb.	Apr.	June.	Aug.	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
Maine	13.6	15.7	15.2	15.1	14.4	13.0	13.3	14.8	13.5	13.7	12.8	15.0	16.0	15.3	14.4	14.7	14.6	13.5
New Hampshire	12.9	14.2	16.0	15.6	15.0	13.8	14.2	13.9	14.1	14.5	15.0	14.3	15.0	14.8	15.2	15.7	14.2	14.0
Vermont	13.2	14.6	13.6	15.4	14.5	13.5	12.5	12.5	12.5	13.2	13.6	13.5	13.3	12.7	13.4	14.5	11.7	11.8
Massachusetts	16.0	16.7	17.7	19.0	18.1	16.0	16.2	16.6	15.9	16.3	15.7	17.0	17.6	17.0	16.2	16.2	17.0	16.0
Rhode Island	16.0	19.2	20.0	17.0	19.0	17.7	19.0	15.7	15.7	19.3	17.7	17.3	18.3	17.0	17.4	16.2	17.0	15.0
Connecticut	16.0	17.2	16.6	16.2	17.5	16.5	16.2	15.1	15.2	15.8	15.8	16.0	16.5	16.8	17.0	16.4	15.3	15.0
New York	13.5	14.8	16.0	16.5	15.1	13.5	13.4	13.6	13.5	14.3	14.5	14.2	14.5	15.3	14.8	14.2	13.0	12.5
New Jersey	15.7	17.5	18.7	18.8	17.7	17.0	17.5	16.3	15.4	16.6	15.8	16.5	17.0	16.3	17.3	16.7	15.6	14.6
Pennsylvania	12.4	13.9	14.3	14.3	13.7	12.4	12.4	12.7	12.4	13.3	13.2	13.2	14.0	14.0	13.6	13.3	12.2	11.0
North Atlantic	13.5	15.0	15.7	15.0	15.1	13.7	13.7	13.8	13.5	14.3	14.2	14.3	14.9	15.0	14.7	14.4	13.4	12.5
Delaware	12.5	14.7	17.3	16.0	15.3	13.0	12.0	11.7	13.0	13.0	13.5	13.5	14.5	13.7	13.0	13.0	12.0	11.0
Maryland	12.9	14.7	17.2	15.8	14.7	13.2	13.4	13.4	14.0	14.2	14.5	14.6	15.0	15.2	14.5	13.6	12.1	11.5
Virginia	12.9	14.0	15.2	15.1	14.6	13.5	12.6	12.6	12.8	12.9	13.4	13.7	15.0	14.3	13.2	13.3	12.7	11.6
West Virginia	11.5	11.6	12.4	13.1	12.1	12.0	11.7	11.4	11.6	11.7	12.0	11.7	12.4	12.9	13.1	12.4	11.4	10.6
North Carolina	10.8	11.5	12.7	12.0	12.2	11.5	10.9	10.8	10.7	11.0	11.2	12.0	12.3	12.4	11.7	11.5	10.8	10.5
South Carolina	11.2	10.7	11.4	12.0	11.5	12.5	13.1	11.1	11.0	13.1	11.0	11.4	12.0	13.0	11.5	12.4	11.2	12.0
Georgia	12.0	12.0	13.4	12.6	14.2	13.5	13.5	12.0	12.6	12.7	12.9	13.5	13.2	12.4	12.8	13.0	13.0	12.5
Florida	12.4	14.0	14.2	12.7	14.0	15.0	12.9	12.8	12.1	13.0	12.6	12.0	14.0	14.1	14.2	13.6	14.7	15.5
South Atlantic	11.9	13.6	13.8	13.4	13.5	12.9	12.5	11.9	12.1	11.5	12.5	12.8	13.4	13.3	12.8	12.7	12.1	11.7
Ohio	11.5	12.7	13.2	12.5	12.0	9.7	10.0	10.2	10.9	11.2	11.6	11.2	11.2	11.3	11.3	10.7	9.5	8.8
Indiana	11.4	12.5	12.6	12.5	11.3	9.3	9.4	10.1	10.1	10.1	10.5	10.2	9.9	10.3	10.0	10.2	9.2	8.5
Illinois	11.2	12.5	12.7	12.5	11.4	9.7	9.5	9.9	9.9	10.5	10.7	10.1	10.6	10.4	10.4	10.2	9.7	8.9
Michigan	11.3	12.2	11.9	12.2	11.7	10.0	10.2	10.5	10.2	10.9	11.1	10.7	10.8	10.7	10.9	10.5	9.4	8.7
Wisconsin	10.6	11.6	12.3	12.4	10.9	9.5	10.0	10.5	11.0	10.8	11.1	10.8	11.4	11.5	11.0	10.9	10.3	9.0
N. C. E. Miss. R	11.2	12.4	12.6	12.4	11.5	9.6	9.8	10.2	10.4	10.7	11.0	10.6	10.8	10.8	10.7	10.5	9.6	8.8
Minnesota	9.3	10.1	10.1	10.4	9.6	8.8	9.2	9.0	9.0	9.2	9.8	9.1	8.9	9.8	9.8	9.1	8.4	8.0
Iowa	10.4	10.9	10.6	11.1	10.2	8.7	8.6	8.7	9.0	8.9	9.1	9.0	9.0	9.4	9.4	9.4	8.3	7.8
Missouri	10.5	12.0	12.3	11.1	10.2	9.0	9.1	9.2	9.4	9.9	10.2	9.9	10.1	9.9	9.6	9.5	8.7	7.7
North Dakota	9.6	10.4	10.1	10.5	10.4	9.0	8.7	8.7	9.2	9.4	9.2	9.5	9.5	9.7	10.6	9.7	9.3	8.5
South Dakota	9.4	9.1	9.3	9.5	9.4	8.6	8.1	9.2	8.7	8.5	8.6	8.5	8.8	8.9	8.6	8.5	8.5	8.0
Nebraska	9.1	9.6	10.2	10.5	9.7	8.5	7.8	8.4	8.4	8.6	8.3	8.6	8.7	9.0	8.7	8.6	8.2	7.7
Kansas	9.5	10.4	10.5	10.2	9.8	8.7	8.5	8.7	8.8	8.8	9.0	8.9	8.4	8.7	8.6	8.5	8.2	7.5
N. C. W. Miss. R	9.9	10.7	10.8	10.7	10.0	8.8	8.7	8.8	9.0	9.1	9.3	9.1	9.1	9.4	9.3	9.1	8.4	7.8
Kentucky	10.8	11.6	12.0	11.4	11.1	9.9	9.7	10.1	9.9	10.5	10.7	10.8	11.5	10.9	10.4	10.2	9.8	8.3
Tennessee	10.5	11.2	12.7	11.8	11.3	10.3	10.4	9.9	10.0	10.4	10.5	10.4	11.5	11.0	10.2	10.2	10.3	9.1
Alabama	10.5	11.0	12.0	10.6	11.8	12.2	11.8	12.0	10.6	11.0	11.1	10.8	11.5	11.6	11.6	12.3	12.7	12.0
Mississippi	12.0	11.3	11.7	11.4	11.4	12.5	11.8	11.1	11.7	11.1	11.1	12.2	11.9	11.6	11.6	11.8	11.0	11.2
Louisiana	12.0	12.8	14.0	12.9	13.4	13.5	12.7	13.0	13.0	12.8	13.4	13.8	12.9	12.5	14.0	13.8	14.3	13.5
Texas	9.0	9.0	9.4	9.6	9.8	9.7	9.1	8.9	8.4	9.1	9.3	9.3	9.4	9.5	9.3	9.3	9.4	9.0
Oklahoma	8.7	9.9	10.2	9.7	9.4	9.5	9.3	8.9	8.8	8.8	8.6	9.0	8.8	9.1	8.4	8.7	8.6	7.6
Arkansas	9.0	9.4	10.4	10.5	10.2	9.7	9.6	10.3	10.2	9.8	10.0	10.0	10.1	9.5	10.7	9.6	9.4	8.8
South Central	10.1	10.5	11.2	10.8	10.8	10.6	10.2	10.2	9.9	10.2	10.3	10.5	10.7	10.5	10.5	10.4	10.4	9.6
Montana	15.4	15.5	14.8	16.5	14.6	13.7	14.6	15.2	15.6	15.3	14.8	14.8	14.8	14.6	14.6	13.8	12.9	13.5
Wyoming	15.5	16.6	17.2	15.4	15.7	15.6	17.5	13.8	13.5	15.9	14.9	13.5	12.7	15.0	15.3	15.7	12.3	14.5
Colorado	13.0	13.4	14.8	15.7	13.0	12.5	12.4	13.1	13.3	12.9	12.1	12.7	13.5	14.1	13.8	13.6	13.1	11.5
New Mexico	13.0	13.6	11.9	13.2	12.4	12.8	12.6	13.4	14.5	13.2	11.8	12.5	14.4	14.2	14.7	12.7	14.6	15.0
Arizona	20.0	19.0	17.6	15.7	13.9	17.0	14.6	20.7	16.2	18.7	16.6	17.0	17.2	15.9	18.0	19.7	19.0	17.6
Utah	12.3	12.2	12.8	14.7	13.7	12.5	13.8	13.2	12.3	11.5	11.9	12.5	12.0	13.2	13.1	12.5	12.7	12.0
Nevada	19.0	22.0	16.0	18.0	15.0	18.0	18.4	15.7	14.4	16.2	16.8	19.7	21.0	15.4	20.0	19.1	18.9	18.0
Idaho	11.9	11.1	12.5	13.8	14.8	12.1	12.0	14.6	12.5	14.2	12.8	12.6	12.1	12.1	12.5	12.0	11.6	11.4
Washington	12.0	14.5	15.2	15.5	14.5	14.8	14.0	13.8	14.9	14.8	15.0	15.0	13.5	13.7	13.6	13.9	13.4	12.5
Oregon	13.0	12.7	13.0	13.4	12.4	13.8	13.8	13.3	13.4	14.4	13.7	14.5	14.3	13.5	13.7	13.5	13.1	12.3
California	15.0	14.5	14.7	14.6	14.4	15.6	15.0	15.0	14.8	15.6	15.1	14.7	15.2	14.8	14.9	15.3	14.3	15.0
Far Western	14.0	14.0	14.4	14.7	13.9	14.5	14.2	14.4	14.3	14.8	14.3	14.3	14.3	14.2	14.3	14.4	13.7	13.6
United States	11.1	11.9	12.4	12.2	11.6	10.6	10.5	10.6	10.6	10.8	11.0	11.0	11.2	11.2	11.1	10.9	10.3	9.6

TRANSPORTATION.

Tonnage carried on railways in the United States, 1906–1910.[1]

[Tons of 2,000 pounds.]

Products.	Year ending June 30—				
	1906	1907	1908	1909	1910
FARM PRODUCTS.					
Animal matter:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Animals, live	11,089,456	11,727,889	11,541,195	11,699,070	11,502,305
Packing-house products—					
Dressed meats	1,813,485	1,952,538	2,081,155	2,131,803	2,274,220
Hides (including leather)	1,028,148	1,082,585	937,872	1,155,884	1,214,849
Other packing-house products	2,480,537	2,312,313	2,054,744	1,982,194	1,760,583
Total packing-house products	5,322,170	5,347,436	5,073,771	5,269,881	5,249,652
Poultry (including game and fish)	867,811	838,905	717,201	713,012	698,356
Wool	353,436	329,786	317,391	403,904	366,995
Other animal matter	1,369,952	2,229,470	1,985,592	2,507,485	2,476,836
Total animal matter	19,002,825	20,473,486	19,635,150	20,593,352	20,294,144
Vegetable matter:					
Cotton	3,428,880	4,332,664	3,419,173	3,950,479	3,023,757
Fruit and vegetables	8,921,262	9,719,117	9,516,962	9,762,769	11,339,921
Grain and grain products—					
Grain	35,856,333	36,715,384	33,058,061	34,111,231	37,420,965
Grain products—					
Flour	7,331,610	7,880,527	6,871,886	7,744,810	8,038,684
Other grain products	5,042,884	5,698,119	5,153,412	5,210,092	6,005,219
Total grain and grain products	48,230,827	50,294,030	45,083,359	47,066,133	51,464,868
Hay	5,479,755	5,847,828	5,446,336	5,453,515	5,975,949
Sugar	2,793,864	2,610,287	2,589,091	2,499,122	2,848,145
Tobacco	882,235	928,151	802,597	794,433	943,071
Other vegetable matter	3,258,761	5,908,281	5,397,516	6,656,391	5,989,021
Total vegetable matter	72,995,584	79,640,358	72,255,034	76,182,842	81,584,732
Total farm products	91,998,409	100,113,844	91,890,184	96,776,194	101,878,876
OTHER FREIGHT.					
Products of mines	435,450,476	476,899,638	444,216,023	459,560,732	544,604,373
Products of forests	92,187,351	101,617,724	90,475,081	97,104,700	113,010,825
Manufactures (except sugar)	118,664,874	135,011,156	102,271,178	106,178,007	136,830,246
All other (including freight in less than carload lots)	81,863,517	79,542,610	68,363,633	66,873,132	72,139,689
Grand total	820,164,627	893,184,972	797,216,099	826,492,765	968,464,009

[1] Compiled from reports of the Interstate Commerce Commission. Original shipments only, excluding freight received by each railway from connecting railways and other carriers.

TRANSPORTATION—Continued.

Average receipts by railroads for freight traffic, per short ton per mile, 1890–1910.[1]

Year ending June 30—	Group.[2] I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	Total United States.
Mean:	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1891–1895	1.302	0.745	0.661	0.765	0.946	0.941	1.215	1.138	1.256	1.478	0.874
1896–1900	1.173	.632	.575	.618	.840	.845	1.118	1.005	1.041	1.176	.762
1901–1905	1.173	.666	.596	.682	.827	.779	.976	.979	1.014	1.046	.763
1906–1910	1.133	.647	.593	.683	.818	.744	.932	.964	1.038	1.178	.755
1901	1.151	.646	.568	.641	.802	.789	1.043	.971	1.018	1.055	.750
1902	1.172	.664	.576	.650	.816	.787	.994	.978	.984	1.037	.757
1903	1.167	.667	607	.714	.827	.774	.980	.962	.974	1.005	.763
1904	1.196	.686	.620	.716	.851	.779	.964	.998	1.000	1.036	.780
1905	1.179	.665	.607	.691	.839	.766	.900	.988	1.096	1.098	.766
1906	1.172	.650	.594	.690	.813	.745	.894	.947	1.009	1.103	.748
1907	1.145	.655	.598	.703	.827	.743	.933	.966	1.051	1.163	.759
1908	1.110	.643	.594	.696	.825	.735	.942	.953	1.002	1.204	.754
1909	1.123	.647	.589	.669	.824	.748	.945	.981	1.070	1.223	.763
1910	1.115	.641	.588	.655	.802	.751	.945	.971	1.056	1.196	.753

[1] Compiled from reports of the Interstate Commerce Commission.

[2] Group I comprises the railroads of the New England States; Group II, New York (east of Buffalo), Pennsylvania (east of Pittsburgh), New Jersey, Delaware, Maryland, and northern part of West Virginia; Group III, New York (west of Buffalo), Pennsylvania (west of Pittsburgh), Ohio, Indiana, and the southern peninsula of Michigan; Group IV, Virginia, central and southern West Virginia, North Carolina, and South Carolina; Group V, Kentucky, Tennessee, Georgia, Florida, Alabama, Mississippi, and Louisiana (east of the Mississippi River); Group VI, northern peninsula of Michigan, Wisconsin, Illinois, Minnesota, Iowa, Missouri (north of the Missouri River), North Dakota (east of the Missouri River), and South Dakota (east of the Missouri River); Group VII, North Dakota (west of the Missouri River), South Dakota (west of the Missouri River), Nebraska, Montana, Wyoming, and northern Colorado; Group VIII, Missouri (south of the Missouri River), Arkansas, Kansas, Oklahoma, central and southern Colorado, northeastern New Mexico, and the "Panhandle" of Texas; Group IX, Texas (except the "Panhandle") and southeastern New Mexico; Group X, Idaho, Utah, Nevada, western New Mexico, Arizona, Oregon, Washington, and California.

Corn and wheat: Mean proportional export freight rates per 100 pounds from Kansas City and Omaha, by rail, to leading Gulf and Atlantic ports, 1905–1911.[1]

Year.	To New Orleans or Galveston from— Kansas City.		Omaha.		From Kansas City or Omaha to— Boston or New York.		Philadelphia.		Baltimore.	
	Corn.	Wheat.	Corn.	Wheat.	Corn.	Wheat.	Corn.	Wheat.	Corn.	Wheat.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1905	14.8	[2] 16.1	15.8	[2] 17.4	22.2	[3] 25.0	21.2	[3] 24.0	20.7	[3] 23.5
1906	16.5	17.1	17.5	18.1	23.4	[4] 21.5	22.4	[4] 20.5	21.9	[4] 20.0
1907	16.9	17.9	17.9	18.9	23.4	24.4	22.4	23.4	21.9	22.9
1908	17.5	18.5	18.5	19.5	24.0	25.0	23.0	24.0	22.5	23.5
1909	17.5	18.5	18.5	19.5	24.0	25.0	23.0	24.0	22.5	23.5
1910	17.5	18.5	18.5	19.5	24.0	25.0	23.0	24.0	22.5	23.5
1911	17.5	18.5	18.5	19.5	24.0	25.0	23.0	24.0	22.5	23.5

[1] Data furnished by the Interstate Commerce Commission.
[2] For July 25 to Dec. 31, 1905, inclusive.
[3] For second half of 1905 only.
[4] Average based upon rates in force for two periods, amounting together to about 30 days.

TRANSPORTATION—Continued.

Wheat: Mean annual freight rates per bushel by lake from Chicago to ports west and east of Niagara River, 1871–1910.[1]

[All rates are gold.]

Year.	West of Niagara River.		East of Niagara River.	
	Buffalo.[2]	Depot Harbor.	Ogdensburg.	Montreal.
Mean:	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1871–1875	6.4			
1876–1880	4.0			
1881–1885	2.8			[3] 6.8
1886–1890	3.1			[4] 7.5
1891–1895	2.0		[5] 3.4	[6] 5.6
1896–1900	1.9		[7] 3.4	[8] 5.2
1901–1905	1.6	1.6	[9] 3.7	[10] 4.9
1906–1910	1.4	1.5	4.0	5.0
1906	1.7	1.7	4.0	6.7
1907	1.6	1.6	4.2	5.6
1908	1.1	1.2	4.1	5.5
1909	1.4	1.4	3.7	4.0
1910	1.1		4.0	3.1
1911	1.1	1.0	3.2	3.9

[1] Compiled from weekly quotations in annual reports of the Chicago Board of Trade.
[2] Mean rates to Buffalo from Chicago by sail vessels were: 1871–1875, 6.4 cents; 1876–1880, 4.1; 1881–1885, 3; and by steam vessels: 1871–1875, 6.3 cents; 1876–1880, 4; 1881–1885, 2.7 cents per bushel. For later years, mean rates by sail, when given, were practically the same as by steam vessels.
[3] Average, 1883–1885.
[4] Average, 1886–1889.
[5] Average, 1891, 1893–1895.
[6] Average, 1891, 1892, 1894, 1895.
[7] Average, 1898–1900.
[8] Average, 1896–1898.
[9] Average, 1901–1903, 1905.
[10] 1903 only.

Wheat: Lowest and highest freight rates per bushel by lake to Buffalo from Toledo, Duluth and Chicago, 1882–1911.[1]

Year.	To Buffalo from—					
	Toledo.		Duluth.		Chicago.	
	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1882					1.50	3.50
1883					2.20	5.25
1884					1.60	3.00
1885			1.50	5.00	1.10	3.75
1886	1.75	3.00	3.25	8.00	2.00	5.875
1887	2.25	3.00	5.00	8.00	3.00	6.00
1888	1.50	2.125	2.00	5.00	1.70	4.00
1889	1.75	2.00	2.00	5.00	2.00	3.60
1890	1.50	2.00	2.00	5.00	1.50	2.50
1891	1.00	3.00	1.25	9.50	1.00	5.25
1892	1.50	2.50	2.25	4.00	1.00	3.00
1893	1.00	2.00	1.25	3.50	1.00	2.75
1894	1.00	2.00	1.25	3.00	.875	3.00
1895	1.00	2.25	2.00	6.00	1.00	3.00
1896	1.25	1.75	1.25	3.00	1.25	2.625
1897	1.00	1.25	1.00	2.50	1.00	2.625
1898	1.00	1.50	1.00	3.50	1.25	3.25
1899	1.50	2.00	2.50	6.00	1.875	3.75
1900	1.25	2.00	1.50	3.75	1.25	3.00
1901	1.25	1.50	1.125	3.75	1.25	2.50
1902	1.125	2.00	1.00	2.25	1.375	2.125
1903	1.125	1.50	1.125	2.75	1.25	2.25
1904	1.00	1.75	1.00	5.00	1.00	3.00
1905	1.125	2.50	1.25	4.00	1.125	3.00
1906	1.375	1.50	1.75	3.00	1.375	2.125
1907	1.00	1.50	1.00	2.50	1.125	2.00
1908	1.00	1.50	1.00	3.50	.75	1.50
1909	1.00	1.50	1.00	2.75	1.10	2.00
1910	1.25	1.25	1.00	2.00	1.00	1.75
1911	1.00	1.25	.875	3.00	.75	1.50

[1] Compiled from annual reports of the Buffalo Merchants' Exchange and Buffalo Chamber of Commerce, for 1882–1909, except figures for Toledo, 1905–1909, which were supplied by the secretary of the Toledo Produce Exchange. Data for later years for Toledo supplied by the Toledo Produce Exchange, for Duluth by the Duluth Board of Trade, and for Chicago by the Chicago Board of Trade.

TRANSPORTATION—Continued.

Corn and wheat: Mean freight rates per bushel from Chicago to New York, 1876–1911.[1]

[All rates are gold.]

Year.	Corn.			Wheat.		
	By lake and canal.[2]	By lake and rail.	By all rail.	By lake and canal.[2]	By lake and rail.	By all rail.
Mean:	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1876–1880	9.93	12.04	16.12	10.85	13.17	17.96
1881–1885	7.07	9.44	13.33	7.69	10.41	14.29
1886–1890	7.18	9.63	13.24	7.87	10.53	14.91
1891–1895	5.78	7.12	12.64	6.21	7.72	13.70
1896–1900	4.65	5.61	10.20	5.23	6.13	11.61
1901–1905	4.54	5.29	9.89	5.21	5.94	10.56
1906–1910	5.34	5.87	9.42	5.78	6.62	10.09
1901	4.61	5.16	9.21	5.11	5.54	9.88
1902	4.83	5.51	9.94	5.26	5.89	10.62
1903	4.85	5.78	10.54	5.40	6.37	11.29
1904	3.63	4.82	10.38	4.73	5.50	11.12
1905	4.76	5.19	9.40	5.53	6.40	9.90
1906	5.51	5.72	9.52	6.03	6.35	10.20
1907	6.12	6.20	10.17	6.65	7.09	10.90
1908	5.62	5.79	9.89	6.05	6.60	10.60
1909	4.87	5.89	9.30	5.24	6.49	9.96
1910	4.59	5.77	8.20	4.92	6.57	8.80
1911	4.87	5.20	8.96	5.25	5.36	9.60

[1] Data furnished by the Chicago Board of Trade. [2] Including Buffalo charges and tolls prior to 1898.

Meats, packed: Mean railroad freight rates per 100 pounds from Cincinnati to New York, 1881–1911.

Year.	Rate.	Year.	Rate.	Year.	Rate.
Mean:	*Cents.*		*Cents.*		*Cents.*
1881–1885	25.1	1901	26.0	1907	26.0
1886–1890	25.3	1902	26.0	1908	26.0
1891–1895	25.3	1903	26.0	1909	26.0
1896–1900	25.8	1904	26.0	1910	26.0
1901–1905	25.8	1905	25.0	1911	26.0
1906–1910	26.0	1906	26.0		

Live stock and dressed meats: Mean freight rates per 100 pounds from Chicago to New York, by rail, 1881–1911.

Year.	Cattle.	Hogs.	Sheep.	Horses and mules.	Dressed beef.	Dressed hogs.		Year.	Cattle.	Hogs.	Sheep.	Horses and mules.	Dressed beef.	Dressed hogs.	
						Refrigerator cars.	Common cars.							Refrigerator cars.	Common cars.
Mean:	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*		*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
1881–1885	34.6	29.2	50.2	60	56.4	......	......	1903	28	30	30	60	45.0	45.0	45.0
1886–1890	27.2	29.2	34.6	60	51.0	48.8	46.0	1904	28	30	30	60	45.0	45.0	45.0
1891–1895	27.8	27.6	30.0	60	45.0	45.0	45.0	1905	28	30	30	60	45.0	45.0	45.0
1896–1900	27.4	29.0	29.0	60	44.0	44.0	44.0	1906	28	30	30	60	45.0	45.0	45.0
1901–1905	28.0	30.0	30.0	60	43.8	43.8	43.8	1907	28	30	30	60	45.0	45.0	45.0
1906–1910	28.0	30.0	30.0	60	45.0	45.0	45.0	1908	28	30	30	60	45.0	45.0	45.0
								1909	28	30	30	60	45.0	45.0	45.0
1901	28	30	30	60	42.9	42.9	42.9	1910	28	30	30	60	45.0	45.0	45.0
1902	28	30	30	60	41.2	41.2	41.2	1911	28	30	30	60	45.0	45.0	45.0

TRANSPORTATION—Continued.

Cotton: Mean annual quotations of freight rates per 100 pounds, by coastwise vessels, to New York from New Orleans and Savannah, 1886–1911.[1]

Year.	To New York from— New Orleans.	To New York from— Savannah.[2]	Year.	To New York from— New Orleans.	To New York from— Savannah.[2]
Mean:	*Cents.*	*Cents.*		*Cents.*	*Cents.*
1886–1890	36.0	26.9	1904	30.0	20.0
1891–1895	33.0	21.3	1905	29.0	20.0
1896–1900	29.2	19.9	1906	25.0	20.0
1901–1905	29.8	20.7	1907	25.0	20.0
1906–1910	25.0	19.9	1908	25.0	20.0
			1909	25.0	20.0
1901	30.0	23.3	1910	25.0	[3] 19.6
1902	30.0	20.0	1911	25.0	18.0
1903	30.0	20.0			

[1] Compiled from quotations published in daily newspapers or furnished by steamship agents.
[2] In 1901–1910 the rates from Savannah to New York, which included lighterage in New York Harbor, were about 3 cents per 100 pounds above the rates shown in this table. Rate for 1911 includes lighterage.
[3] For shipments of less than 50,000 pounds. Rates, including lighterage in New York Harbor, for shipments of 50,000 pounds and over was, in 1910, 18.4 cents.

Compressed cotton: Mean freight rates per 100 pounds from New Orleans and Memphis, by rail, to North Atlantic ports, 1881–1911.

Year.	From New Orleans to— Boston.	New York.	Philadelphia.	Baltimore.	From Memphis to— New York.	Boston.	Year.	From New Orleans to— Boston.	New York.	Philadelphia.	Baltimore.	From Memphis to— New York.	Boston.
Mean:	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*		*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
1881–1885	58.2	53.2	52.8	52.2	61.8	66.2	1903	55	50	50	50	50.5	55.5
1886–1890	51.8	46.8	45.2	44.4	50.8	55.6	1904	55	50	50	50	50.5	50.5
1891–1895	53.8	49.6	49.6	49.6	49.8	54.6	1905	55	50	50	50	40.5	45.5
1896–1900	54.4	49.4	49.4	49.4	49.2	54.2	1906	55	50	50	50	40.5	45.5
1901–1905	55.0	50.0	50.0	50.0	48.5	52.5	1907	55	50	50	50	40.5	45.5
1906–1910	55.0	50.0	50.0	50.0	41.7	46.7	1908	55	50	50	50	42.5	47.5
							1909	55	50	50	50	42.5	47.5
1901	55	50	50	50	50.5	55.5	1910	55	50	50	50	42.5	47.5
1902	55	50	50	50	50.5	55.5	1911	55	50	50	50	42.5	47.5

Grain (except oats), cotton, and lard: Mean monthly quotations of ocean freight rates from United States ports to Liverpool, 1911.

Article and port.	Mean for month— Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean for year.
Grain, except oats (per 60 pounds):	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Boston	3.7	3.7	3.5	3.0	3.2	2.9	3.0	3.7	4.8	5.1	5.8	6.2	4.0
New York[1]	4.2	4.2	4.2	3.3	3.2	3.2	3.4	3.3	5.1	5.5	6.2	6.8	4.4
Baltimore[1]	5.0	4.2	3.7	3.2	3.4	2.9	3.7	5.0	5.2	5.5	5.2	......	4.3
New Orleans	7.4	6.6	5.9	5.2	5.2	5.2	5.8	6.3	6.8	7.7	8.3	8.4	6.6
Galveston	5.2	5.2	5.2	5.2	5.2	5.2	5.2	6.0	6.8	6.8	6.8	6.8	5.8
Cotton (per 100 pounds):													
Boston	12.0	12.0	12.0	12.0	12.0	12.0	12.5	16.5	20.0	20.0	21.5	22.5	15.4
New York	17.5	18.0	18.0	15.0	15.0	15.0	15.0	20.0	26.9	25.6	25.0	31.0	20.2
Baltimore	19.0	18.0	18.0	18.0	14.0	14.0	14.0	17.0	24.0	25.0	25.0	29.0	19.6
New Orleans	36.0	34.2	32.2	30.0	30.0	30.0	30.0	35.0	40.0	39.5	44.6	41.8	35.3
Galveston	36.0	30.0	29.0	29.0	29.0	29.0	29.0	35.0	40.0	39.0	42.0	42.0	34.1
Lard, small packages (per 100 pounds):													
Boston	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	23.1	22.6
New York	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Baltimore	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	24.9	22.7
New Orleans	30.0	30.0	30.0	30.0	27.0	27.0	27.0	27.0	30.0	30.0	30.0	33.8	29.3
Galveston	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	30.0	30.0	30.0	35.0	27.1

[1] Preliminary.

TRANSPORTATION—Continued.

Grain (except oats) and cotton: Mean annual quotations of ocean freight rates per 100 pounds from various United States ports to Europe, 1886–1911.[1]

Calendar year.	Grain (except oats).				Cotton.					
	To Liverpool from—			To Cork for orders, from San Francisco.	To Liverpool from—			To Bremen from—		
	New York.	Baltimore.[2]	New Orleans.		New York.	Savannah.	New Orleans.	New York.	Savannah.	New Orleans.
Mean:	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1886–1890	10.4	11.8	15.5	32.1	31.4	67.2	60.7	45.4	72.2	68.6
1891–1895	8.8	9.9	12.2	31.2	25.7	44.9	40.2	[3] 33.1	49.5	46.7
1896–1900	10.7	11.5	14.8	29.1	23.5	44.8	41.6	31.7	42.8	47.9
1901–1905	4.8	5.8	8.7	26.2	14.2	28.2	32.2	21.6	26.5	33.3
1906–1910	5.5	5.8	10.3	25.3	16.0	28.4	31.8	20.0	28.7	32.6
1901	4.4	6.3	8.7	41.5	13.4	31.4	32.5	23.2	30.1	37.6
1902	5.0	6.2	7.2	32.1	12.5	26.6	28.7	18.3	24.1	30.5
1903	5.0	5.4	8.3	18.5	14.8	26.8	34.6	23.3	26.1	33.8
1904	3.9	4.8	8.8	15.8	13.7	28.4	31.4	21.9	25.4	31.9
1905	5.7	6.4	10.6	23.2	16.6	27.8	33.8	21.2	26.6	32.7
1906	5.0	6.1	11.4	25.0	17.0	30.4	34.2	21.3	31.0	36.2
1907	6.1	6.3	11.8	24.8	18.6	31.3	35.9	20.5	32.4	36.6
1908	5.5	6.5	10.1	25.6	13.7	31.9	29.9	21.0	32.0	30.6
1909	5.7	5.1	8.8	25.5	13.4	25.4	28.0	17.7	25.1	28.0
1910	5.2	4.5	9.3	25.5	17.1	22.8	31.1	19.3	23.1	31.2
1911	[4] 4.4	[4] 4.3	6.6	24.2	20.2	29.2	35.3	26.5	29.6	36.5

[1] The rates in this table for grain (except oats) from New York were computed from data in the annual reports of the New York Produce Exchange, except for the last year; from Baltimore, from reports of the Baltimore Chamber of Commerce. All other figures were computed from rates quoted in newspapers and in circulars issued by freight brokers and transportation companies.
[2] Mean of daily quotations.
[3] Mean, 1891, 1893–1895.
[4] Preliminary.

Grain (except oats), flour, and provisions: Mean rates per 100 pounds through from Chicago to European ports, by all-rail to seaboards and thence by steamers, 1883–1911.[1]

Year.	Grain.			Sacked flour.			Provisions.										
	Glasgow.	Liverpool.	London.	Glasgow.	Liverpool.	London.	Amsterdam.	Antwerp.	Bordeaux.	Copenhagen.	Glasgow.	Hamburg.	Liverpool.	London.	Rotterdam.	Stettin.	Stockholm.
Mean:	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
1883–1885	[2] 29.4	36.8	[2] 29.8	[2] 36.0	33.3	[2] 35.0	56.5	53.5	[3] 57.0	58.5	[2] 46.5	53.4	44.2	[2] 44.7	52.9	60.2	67.9
1886–1890	37.7	[4] 35.6	[5] 38.4	39.9	36.1	40.3	56.0	50.9	63.4	57.9	53.4	54.6	46.3	53.7	56.0	58.2	64.4
1891–1895	36.9	34.5	36.2	38.2	36.1	37.6	53.0	49.2	64.7	58.1	50.8	51.5	46.5	49.3	52.6	58.1	68.3
1896–1900	33.8	32.1	32.8	35.5	33.4	35.4	50.9	50.4	63.4	56.1	51.0	50.0	45.2	49.0	50.9	56.1	66.9
1901–1905	22.5	20.9	22.1	23.6	23.0	24.1	42.9	45.9	53.9	47.0	44.2	44.4	37.8	42.6	42.7	46.9	50.4
1906–1910	18.3	18.8	19.0	22.4	20.6	22.6	46.4	48.3	55.1	53.3	46.6	48.7	43.0	46.8	46.0	51.7	54.9
1906	19.2	18.8	19.2	23.6	20.5	22.5	46.0	47.6	53.0	51.0	45.6	49.0	41.0	46.3	46.0	50.0	53.5
1907	19.7	19.2	20.5	23.9	21.2	23.6	45.0	45.6	55.0	51.0	46.9	46.0	40.8	46.3	45.0	49.0	53.0
1908	18.6	19.0	19.5	22.1	20.8	23.2	45.0	49.6	55.0	54.0	46.9	49.6	42.6	46.3	45.0	51.8	54.7
1909	18.0	18.9	18.2	21.0	20.7	21.5	48.0	49.4	55.0	55.3	46.9	49.1	45.4	47.5	47.0	53.9	56.7
1910	15.9	18.2	17.8	21.5	19.8	22.0	48.0	49.4	57.5	55.3	46.9	50.0	45.4	47.6	47.0	53.9	56.7
1911	20.0	19.8	20.9	25.0	23.0	25.2	49.0	49.4	57.5	57.0	46.9	50.0	45.4	47.6	48.0	55.6	59.8

[1] Data furnished by Chicago Board of Trade.
[2] Mean for 1884, and 1885.
[3] Mean for 1884, 1885, and 10 months in 1883.
[4] Mean for 1887, 1888, 1889, 1890, and January, 1886.
[5] Mean for 1886, 1887, 1888, 1890.

TRANSPORTATION—Continued.

Average freight charge on Pacific coast wheat per ton per mile, over selected routes, in 1910.

[Based upon tons of 2,000 pounds and statute miles.]

Route.	Cents per ton per mile.
By wagon, from farms to shipping points (in 1906):	
Washington	24.841
Idaho	20.952
Oregon	17.388
California	14.331
By electric railroad:	
From Salem, Oreg., to Portland, Oreg	3.219
From Marysville, Cal., to Sacramento, Cal	2.392
From Chico, Cal., to Sacramento, Cal	2.205
From Moscow, Idaho, to Spokane, Wash	1.429
By steam railroad:	
From Ellensburg, Wash., to Tacoma, Wash	1.870
From Merced, Cal., to San Francisco, Cal	1.513
From Lewiston, Idaho, to Portland, Oreg	.952
From Portland, Oreg., to San Francisco, Cal	.402
By river:	
From The Dalles, Oreg., to Portland, Oreg	1.316
From Sacramento, Cal., to San Francisco, Cal	1.000-1.200
From Red Bluff, Cal., to Sacramento, Cal	1.020
From Lewiston, Idaho, to Portland, Oreg	.823- .900
By coastwise steamships:	
From Seattle, Wash., to Skagway, Alaska	.505
From Portland, Oreg., to San Francisco, Cal	.166- .266
By ocean steamships:	
From Tacoma, Wash., to Liverpool, England, via Magellan Straits	.0363-.037[illegible]
By sail vessels:	
From Tacoma, Wash., to Liverpool, England, via Cape Horn	.0210-.0294

IMPORTS AND EXPORTS OF AGRICULTURAL PRODUCTS.[1]

Agricultural imports of the United States during the five years ending June 30, 1911.

Article imported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER.										
Animals, live:										
Cattle—										
For breeding purposes, number	835	$122,230	3,188	$149,142	3,049	$140,713	2,611	$291,139	2,441	$362,220
Other.................number..	31,567	442,892	89,168	1,358,168	136,135	1,858,709	193,327	2,708,685	180,482	2,590,857
Total cattle............do....	32,402	565,122	92,356	1,507,310	139,184	1,999,422	195,938	2,999,824	182,923	2,953,077
Horses—										
For breeding purposes...do....	3,644	1,574,020	3,562	1,325,784	4,953	1,658,640	7,867	2,660,241	6,331	2,055,418
Other...................do....	2,436	404,085	1,925	278,608	2,131	348,636	3,753	635,781	3,262	636,656
Total horses...........do....	6,080	1,978,105	5,487	1,604,392	7,084	2,007,276	11,620	3,296,022	9,593	2,692,074
Sheep—										
For breeding purposes...do....	3,081	67,555	5,609	104,509	4,860	89,272	6,335	135,019	5,341	116,277
Other...................do....	221,717	1,052,870	219,156	978,097	97,803	413,368	119,817	561,860	48,114	261,348
Total sheep............do....	224,798	1,120,425	224,765	1,082,606	102,663	502,640	126,152	696,879	53,455	377,625
All other, including fowls..........	....	680,630	....	583,151	....	528,333	....	846,945	....	828,188
Total live animals............	....	4,344,282	....	4,777,459	....	5,037,671	....	7,839,670	....	6,850,964
Beeswax.......................pounds..	917,088	264,637	671,526	194,769	764,937	231,559	972,145	282,905	902,904	270,112
Dairy products:										
Butter......................do....	441,755	117,835	780,608	182,897	646,320	141,917	1,360,245	298,023	1,007,826	247,961
Cheese......................do....	33,848,766	5,704,012	32,530,830	5,586,706	35,548,143	5,866,154	40,817,524	7,053,570	45,568,797	7,920,244
Cream....................gallons..	(2)	(2)	(2)	(2)	(2)	(2)	731,783	577,715	2,332,875	1,873,293
Milk..........................	....	10,188	....	11,496	....	23,428	....	63,339	....	75,090
Total dairy products.........	....	5,832,035	....	5,781,099	....	6,031,499	....	7,992,647	....	10,116,588
Eggs.........................dozens..	231,859	26,276	231,939	25,850	288,650	36,937	818,267	110,738	1,573,394	225,744
Egg yolks...................pounds..	(2)	10,616	(2)	10,845	(2)	6,232	869,923	56,121	433,405	30,798

Feathers and downs, crude	....	4,401,131	....	4,360,721	....	5,507,974	....	7,113,778	....	5,865,830
Fibers, animal:										
Silk—										
Cocoons..........pounds..	71,223	23,807	187	292	14,016	3,931	48,661	14,426	163,867	74,261
Raw, or as reeled from the cocoon..........pounds..	16,722,207	70,229,518	15,424,041	63,665,534	23,333,750	78,830,568	20,363,327	65,424,784	22,379,998	72,713,984
Waste..........do....	1,950,474	1,158,574	1,237,904	881,077	1,840,191	1,069,087	3,045,235	1,690,393	4,122,226	2,210,020
Total silk..........do....	18,743,904	71,411,899	16,662,132	64,546,903	25,187,957	79,903,586	23,457,223	67,129,603	26,666,091	74,998,265
Wool, and hair of the camel, goat, alpaca, and like animals—										
Class 1, clothing.......pounds..	82,982,116	21,378,304	45,798,303	10,278,199	142,580,993	29,455,598	111,592,978	27,231,052	40,104,845	9,044,321
Class 2, combing.........do....	10,671,378	3,235,281	13,332,540	3,624,617	21,952,259	4,591,559	31,614,235	7,931,145	12,456,468	3,280,683
Class 3, carpet..........do....	110,194,051	16,920,443	66,849,681	9,762,122	101,876,052	11,124,837	120,721,019	16,058,647	85,086,328	10,903,001
Total wool..........do....	203,847,545	41,534,028	125,980,524	23,664,938	266,409,304	45,171,994	263,928,232	51,220,844	137,647,641	23,228,005
Total animal fibers....do....	222,591,449	112,945,927	142,642,656	88,211,841	291,597,261	125,075,580	287,385,455	118,350,447	164,313,732	98,226,270
Gelatin..........do....	(2)	(2)	(2)	(2)	1,247,910	387,232	1,249,856	386,696	1,312,979	387,525
Glue..........do....	6,466,312	596,667	6,731,943	629,032	6,610,894	655,127	8,821,554	861,888	8,335,178	806,208
Honey..........gallons..	175,672	70,854	211,992	98,425	145,691	60,884	103,640	52,968	112,553	62,942
Packing-house products:										
Bladders, other than fish..........	....	11,835	....	4,905	....	7,354	....	(2)	....	38,129
Blood, dried..........	....	94,023	....	40,023	....	91,705	....	221,587	....	446,698
Bones, hoofs, and horns..........	....	845,255	....	733,798	....	777,357	....	1,067,911	....	1,168,924
Bristles—										
Crude, unsorted.......pounds..	11,620	5,325	7,710	7,620	10,129	7,637	37,927	12,987	11,562	9,803
Sorted, bunched, or prepared, pounds..........	3,433,941	3,256,552	2,614,783	2,090,157	2,884,372	2,583,482	3,992,520	3,111,872	3,542,913	2,970,481
Total bristles.......pounds..	3,445,561	3,261,877	2,622,493	2,097,777	2,894,501	2,591,119	4,030,447	3,124,859	3,554,475	2,980,284
Grease..........	....	1,355,739	....	1,103,081	....	1,489,764	....	1,522,327	....	1,714,757
Gut..........	....	103,489	....	113,861	....	128,165	....	149,103	....	153,779
Hair—[3]										
Horse..........pounds..	(2)	3,038,996	(2)	2,770,658	(2)	3,750,524	5,410,930	2,106,730	4,542,930	1,683,820
Other animal..........do....							13,349,752	1,065,061	12,992,338	956,775
Hide cuttings and other glue stock..	....	1,473,188	....	1,265,382	....	1,301,956	....	1,605,432	....	1,633,042

[1] Forest products come within the scope oft he Department of Agriculture and are therefore included in alphabetical order in these tables.
[2] Not stated.
[3] Excluding human hair after July 1, 1909.

20139°—YBK 1911——42

Agricultural imports of the United States during the five years ending June 30, 1911—Continued.

Article imported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER—continued.										
Packing-house products—Continued.										
Hides and skins, other than furs—										
Buffalo hides.........pounds..	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	3,599,386	$542,392
Calfskins.................do....	(2)	(2)	(2)	(2)	(2)	(2)	75,593,451	$17,922,051	59,783,350	14,195,679
Cattle hides...............do....	134,671,020	$20,649,258	98,353,249	$12,044,435	192,252,083	$23,795,602	318,003,538	46,700,139	150,127,796	21,609,430
Goatskins..................do....	101,201,596	31,715,298	63,640,758	17,325,126	104,048,244	26,023,914	115,844,758	30,837,590	86,913,842	21,760,557
Horse and ass skins......do....	(2)	(2)	(2)	(2)	(2)	(2)	19,512,397	3,080,484	10,254,273	1,582,173
Sheepskins [3]............do....	(2)	(2)	(2)	(2)	48,906,326	8,276,637	67,406,131	11,289,158	55,717,039	9,009,063
Other......................do....	135,111,199	30,841,989	120,770,918	25,400,575	99,347,672	20,391,171	12,258,753	2,418,414	8,495,709	1,805,686
Total hides and skins..do....	370,983,815	83,206,545	282,764,925	54,770,136	444,554,325	78,487,324	608,619,028	112,247,836	374,891,395	70,504,980
Meat—										
Sausages, bologna.......do....	451,059	121,205	520,770	108,367	560,873	129,568	555,524	127,274	666,988	140,535
Other, including meat extracts..	....	888,209	....	775,713	....	667,367	....	1,086,966	....	1,201,520
Total meat..................	....	1,009,414	....	884,080	....	796,935	....	1,214,240	....	1,342,055
Oils, animal..............gallons..	132,843	26,671	85,964	16,965	(4)	(4)	(4)	(4)	(4)	(4)
Rennets...................pounds..	....	117,344	....	151,028	....	97,684	....	92,459	....	111,609
Sausage casings...........do....	(4)	1,288,922	(4)	2,182,036	(4)	2,258,648	(4)	2,604,895	4,394,326	2,751,327
Stearin......................do....	1,184,287	93,385	1,434,845	135,739	3,895,254	411,485	8,144,485	952,628	5,715,348	592,119
Other..............................	....	48,188	....	29,968	....	34,722	....	(5)	....	(5)
Total packing-house products.	....	95,974,871	....	66,299,437	....	92,224,742	....	127,975,068	....	86,078,298
Total animal matter.........	....	224,467,296	....	170,389,478	....	235,255,437	....	271,022,926	....	208,921,279
VEGETABLE MATTER.										
Argols, or wine lees...........pounds..	30,540,893	2,562,384	26,738,834	2,305,185	32,115,646	2,641,867	28,182,956	2,220,687	29,175,133	2,938,337
Breadstuffs. (*See* Grain and grain products.)										
Broom corn......................tons..	4	1,663	2	516	1,880	163,645	7,659	933,878	620	54,481
Cider.........................gallons..	8,018	7,842	9,764	11,113	9,704	10,298	7,791	7,606	(4)	(4)
Cocoa and chocolate:										
Cocoa—										
Crude, and leaves and shells of, pounds..................	92,249,819	13,376,562	82,831,242	14,257,250	129,854,749	14,850,328	108,668,070	11,376,061	138,058,341	14,552,879

Prepared, or manufactured, pounds	1,267,733	371,816	1,016,990	311,661	1,287,109	372,195	1,107,203	316,118	(6)	(6)
Total cocoa.........pounds..	93,517,552	13,748,378	83,848,232	14,568,911	131,141,858	15,222,523	109,775,273	11,692,179	138,058,341	14,552,879
Chocolate....................do....	3,541,961	830,611	2,756,452	715,131	1,519,073	339,795	1,295,561	274,247	2,912,536	708,056
Total cocoa and chocolate, pounds	97,059,513	14,578,989	86,604,684	15,284,042	132,660,931	15,562,318	111,070,834	11,966,426	140,970,877	15,260,935
Coffee........................pounds..	985,321,473	78,231,902	890,640,057	67,688,106	1,049,868,768	79,112,129	871,469,516	69,194,353	875,366,797	90,567,788
Coffee substitutes:										
Chicory root—										
Raw, unground.......pounds..	2,597,807	41,680	2,170,633	34,330	6,137,303	99,389	2,595,942	62,410	5,393,373	111,416
Roasted, ground, or otherwise prepared.........pounds..	615,267	25,770	502,792	21,311	644,466	24,947	288,866	11,618	498,441	25,084
Total chicory root.....do....	3,213,074	67,450	2,673,425	55,641	6,781,769	124,336	2,884,808	74,028	5,891,814	136,500
Other........................do....	341,486	23,385	431,603	27,621	499,633	28,941	200,008	17,034	169,201	19,816
Total coffee substitutes.do....	3,554,560	90,835	3,105,028	83,262	7,281,402	153,277	3,084,816	91,062	6,061,015	156,316
Curry and curry powder..............	....	14,983	....	14,350	....	10,276	....	(4)	....	11,333
Fibers, vegetable:										
Cotton....................pounds..	104,791,784	19,930,988	71,072,855	14,172,241	86,518,024	13,622,802	86,037,691	15,816,138	113,768,313	24,776,320
Flax........................tons..	8,656	2,254,112	9,528	2,514,680	9,870	2,542,256	12,761	3,536,062	7,792	2,668,538
Hemp......................do....	8,718	1,534,371	6,213	1,086,805	5,208	799,164	6,423	1,039,833	5,278	938,338
Istle, or Tampico fiber.......do....	14,966	1,369,206	10,174	893,273	9,610	675,887	9,272	645,526	6,874	469,503
Jute and jute butts..........do....	104,489	8,950,918	107,533	6,504,920	156,685	7,216,307	68,155	3,728,448	65,238	4,718,599
Kapok......................do....	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	2,070	465,774
Manila......................do....	54,513	10,876,107	52,467	8,974,617	61,902	7,156,091	93,253	10,517,100	74,308	8,622,491
New Zealand flax...........do....	(7)	(7)	(7)	(7)	(7)	(7)	3,353	362,888	2,679	294,388
Sisal grass..................do....	99,061	14,959,415	103,994	14,047,369	91,451	10,215,887	99,966	11,440,521	117,727	12,092,564
Other.......................do....	22,580	2,295,229	13,575	1,471,419	10,719	1,142,761	12,248	1,148,461	8,468	482,055
Total vegetable fibers........	....	62,170,346	....	49,665,324	....	43,371,155	....	48,234,977	....	55,528,570
Flowers, natural..................	....	32,729	....	42,821	....	41,187	....	43,818	....	45,058
Forest products:										
Charcoal..................bushels..	144,802	8,516	472,670	37,167	886,297	46,660	(4)	(4)	(4)	17,363
Cinchona bark............pounds..	3,515,958	380,552	3,983,825	368,419	3,502,423	263,112	3,300,483	242,087	3,826,048	297,634
Cork wood or cork bark............	....	2,356,052	....	2,092,732	....	2,016,551	....	3,152,280	....	4,274,810

1 Included in "Cattle hides."
2 Included in "Other" hides and skins other than furs.
3 Except sheepskins with the wool on.
4 Not stated.
5 Included in "Other, including meat extracts."
6 Included in "Chocolate."
7 Included in "Other" vegetable fibers.

Agricultural imports of the United States during the five years ending June 30, 1911—Continued.

Article imported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Forest products—Continued.										
Dyewoods, and extracts of—										
Dyewoods—										
Logwood............tons..	38,230	$478,636	21,594	$244,460	17,874	$166,371	32,368	$368,448	(1)	(1)
Other....................	....	54,902	....	55,940	....	45,760	....	(1)	....	(1)
Total dyewoods............	....	533,538	....	300,400	....	212,131	....	368,448	....	(1)
Extracts and decoctions of, pounds..................	4,796,655	379,927	3,959,049	238,649	3,519,733	232,879	3,273,393	197,929	10,556,961	$412,196
Total dyewoods, and extracts of.....................	....	913,465	....	539,049	....	445,010	....	566,377	....	412,196
Guayule plant...........pounds..	1,187,596	24,613	1,524,401	28,583	945,789	18,490	1,146,193	33,462	149,624	6,650
Gums—										
Arabic ....do....	7,068,066	393,581	4,890,897	348,883	4,158,958	275,987	5,451,181	315,154	....	(2)
Camphor—										
Crude...............do....	3,138,070	1,572,863	2,814,299	1,365,269	1,990,499	602,530	3,026,648	921,926	3,726,319	1,118,586
Refined.............do....	(1)	(1)	(1)	(1)	451,362	158,297	477,269	179,965	478,422	161,878
Chicle..................do....	6,732,581	2,139,204	6,089,607	2,027,148	5,450,139	1,987,112	6,793,821	2,547,339	6,508,208	2,899,086
Copal, kauri, and damar.do....	26,681,736	2,835,332	24,966,693	2,813,515	24,861,428	2,388,458	29,357,579	2,961,800	23,021,822	2,080,832
Gambier, or terra japonica do....	28,865,617	977,009	26,681,791	894,752	30,992,245	1,313,997	25,572,655	1,255,296	18,764,507	970,158
India rubber, gutta-percha, etc.—										
Balata...........pounds..	799,201	305,041	584,552	276,756	1,157,018	522,872	399,003	196,878	878,305	624,702
Guayule gum........do....	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	19,749,522	10,443,157
Gutta-joolatong, or East Indian gum ....pounds..	28,437,660	1,085,098	22,803,303	1,039,776	24,826,296	852,372	52,392,444	2,419,223	51,420,872	2,872,633
Gutta-percha........do....	546,890	201,339	188,610	100,305	255,559	82,136	784,501	167,873	1,648,921	390,548
India rubber.........do....	76,963,838	58,919,981	62,233,160	36,613,185	88,359,895	61,709,723	101,044,681	101,078,825	72,046,260	76,244,603
Total India rubber, etc., pounds................	106,747,589	60,511,459	85,809,625	38,030,022	114,598,768	63,167,103	154,620,629	103,862,799	145,743,880	90,575,643
Shellac...............pounds..	17,785,960	5,821,688	13,361,932	4,143,974	19,185,137	3,889,533	29,402,182	3,877,707	15,494,940	2,306,262
Other........................	....	1,234,479	....	939,952	....	1,393,476	....	1,444,938	....	1,862,874

Total gums		75,485,615		50,563,515		75,176,493		117,366,924		101,975,319
Ivory, vegetable..........pounds..	16,602,229	464,931	14,536,288	375,535	20,002,909	609,062	27,066,716	1,104,924	20,851,466	772,065
Naval stores—										
Tar and pitch (of wood), barrels	1,330	6,928	2,523	9,797	1,018	5,150	(1)	(1)	1,719	10,246
Turpentine, spirits of..gallons..	35,386	16,110	76,743	29,210	51,137	17,538	127,090	54,330	204,321	107,978
Total naval stores		23,038		39,007		22,688		54,330		118,224
Palm leaf, natural		14,779		36,855		17,354		28,428		23,040
Tanning materials—										
Hemlock bark..........cords..	6,744	30,757	8,868	43,890	20,373	126,560	16,450	95,667	(4)	(4)
Mangrove bark...........tons..	20,693	426,431	15,192	310,745	12,263	250,409	16,089	402,853	(4)	(4)
Quebracho, extract of .pounds..	79,033,584	2,319,785	79,186,787	2,260,364	102,004,981	2,740,530	95,183,073	3,021,902	92,039,253	3,030,799
Quebracho wood.........tons..	66,810	840,779	48,871	612,971	66,113	731,795	80,210	1,058,647	66,617	984,841
Sumac, ground........pounds..	12,487,103	267,239	8,576,091	227,611	10,974,613	293,249	13,632,861	299,170	(1)	(1)
Other		84,406		125,378		177,716		132,847		698,673
Total tanning materials		3,969,397		3,580,959		4,320,259		5,011,086		4,714,313
Wood, not elsewhere specified—										
Brier root or brierwood and ivy or laurel root		(5)		(5)		(5)		441,347		321,060
Chair cane or reed		(1)		(1)		(1)		246,475		460,573
Cabinet woods, unsawed—										
Cedar..............M feet..		(6)		(6)		(6)	19,294	1,028,588	18,172	995,968
Mahogany...........do....	51,899	3,263,718	41,678	2,566,954	39,828	2,479,976	44,524	3,224,152	43,914	3,171,398
Other		2,091,882		1,464,907		1,406,318		721,084		842,970
Total cabinet woods		5,355,600		4,031,861		3,886,294		4,973,824		5,010,336
Logs and round timber. M feet..	97,573	938,501	131,348	1,264,439	155,095	1,510,767	177,490	1,746,472	173,906	1,815,120
Lumber—										
Boards, deals, planks, and other sawed lumber, M feet	934,195	16,255,350	791,288	15,212,788	846,024	15,946,755	1,054,416	19,372,215	872,374	16,148,980
Laths..................M..		(7)		(7)		(7)	722,423	1,804,139	677,770	1,693,340
Shingles...............do..	881,003	1,940,001	988,081	2,379,242	1,058,363	2,500,398	762,798	1,759,397	642,582	1,387,743
Other		2,764,015		2,665,428		2,452,888		1,185,153		1,553,760
Total lumber		20,959,366		20,257,458		20,900,041		24,120,904		20,783,823
Pulp wood.............cords..	650,366	2,792,751	923,503	4,989,919	727,104	4,333,905	1,000,342	6,392,023	869,955	5,565,273
Rattan and reeds		(5)		(5)		(5)		884,626		925,269

[1] Not stated.
[2] Included in "Other," gums.
[3] Included in "India rubber."
[4] Included in "Other," tanning materials.
[5] Included in "All other," wood.
[6] Included in "Other," cabinet woods, unsawed.
[7] Included in "Other," lumber.

Agricultural imports of the United States during the five years ending June 30, 1911—Continued.

Article imported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Forest products—Continued.										
Wood, not elsewhere specified—Continued.										
Timber, hewn, squared, or sided.............cubic feet..	....	$2,384,743	....	$2,214,268	....	$1,724,177	....	$738,214	....	$838,140
All other....................										
Total wood, n. e. s..........	....	32,430,961	....	32,757,945	....	32,355,184	....	39,543,885	....	35,719,594
Wood pulp—										
Chemical—										
Bleached .....pounds..					85,025,346	2,092,483	153,515,933	3,394,273	161,313,079	3,494,982
Unbleached......do....	477,366,400	6,348,857	532,031,360	7,313,326	268,940,457	4,478,903	374,576,834	5,831,016	413,480,484	6,286,615
Mechanical ....do....					260,279,169	2,057,877	319,347,992	2,542,725	527,002,249	4,198,760
Total wood pulp...do....	477,366,400	6,348,857	532,031,360	7,313,326	614,244,972	8,629,263	847,440,759	11,768,014	1,101,795,812	13,980,357
Total forest products.....	....	122,420,776	....	97,733,092	....	123,920,126	....	178,871,797	....	162,311,565
Fruit juices, n. e. s.:										
Prune juice, or prune wine. gallons..	52,940	35,068	31,584	25,818	31,223	22,092	24,328	18,466	(1)	(1)
Other, including cherry juice, gallons..........................	54,553	35,662	40,467	26,677	31,703	20,734	38,392	27,042		
Total fruit juices, n. e. s., gallons....................	107,493	70,730	72,051	52,495	62,926	42,826	62,720	45,508	(1)	(1)
Fruits:										
Fresh or dried—										
Bananas.............bunches..	(1)	11,883,168	37,003,388	11,391,211	36,973,584	11,012,100	38,156,659	11,642,693	44,699,222	14,375,075
Currants.............pounds..	38,392,779	1,746,941	38,652,656	1,592,018	32,482,111	1,185,106	33,326,030	1,190,020	33,439,565	1,486,263
Dates..................do....	31,270,899	850,558	24,958,343	689,190	21,869,218	526,747	22,693,713	516,704	29,504,592	621,819
Figs...................do....	24,346,173	1,136,924	18,836,574	867,523	15,235,513	691,981	17,362,197	775,319	23,459,728	1,059,340
Grapes............cubic feet..	1,298,469	1,575,521	2,234,508	2,743,356	1,203,419	1,575,620	1,365,310	1,682,994	1,485,159	1,723,022
Lemons..............pounds..	157,859,906	4,253,296	178,490,003	4,388,530	135,183,550	2,623,399	160,214,785	3,136,933	134,968,924	2,985,561
Olives...............gallons..	2,298,480	1,277,973	3,121,788	1,358,897	2,969,329	1,349,023	4,555,075	1,659,801	3,044,947	1,567,546
Oranges.............pounds..	21,267,346	354,495	18,397,429	275,060	8,435,873	137,390	4,676,118	82,457	7,672,186	116,658
Pineapples.....................	....	(2)	....	(2)	....	(2)	....	1,317,462	....	979,721
Plums and prunes....pounds..	323,377	45,386	335,089	49,322	296,123	41,696	....	(2)	....	(2)
Raisins.................do....	3,967,151	364,403	9,132,353	554,633	5,794,320	327,644	5,042,683	296,047	2,479,220	237,422
Other........................	....	1,363,167	....	2,250,813	....	1,912,949	....	920,362	....	971,572

Total fresh or dried	....	24,851,832	....	26,160,553	....	21,383,655	....	23,220,792	....	26,123,999
Prepared or preserved	....	1,272,445	....	1,550,246	....	1,062,775	....	956,368	....	893,633
Total fruits	....	26,124,277	....	27,710,799	....	22,446,430	....	24,177,160	....	27,017,632
Ginger, preserved or pickled...pounds..	472,190	29,810	409,331	27,189	523,360	34,665	527,721	27,585	350,117	22,036
Grain and grain products:										
Grain—										
Barley...bushels..	38,319	14,033	199,741	143,407	2,644	1,440	....	(3)	....	(3)
Corn...do....	10,818	8,337	20,312	15,536	258,065	189,465	....	(3)	....	(3)
Oats...do....	74,552	26,634	364,307	179,714	6,666,989	2,651,699	1,034,511	400,920	107,318	41,990
Rye...do....	158	126	17	16	51	51	....	(3)	....	(3)
Wheat...do....	375,433	237,049	341,617	329,766	41,082	36,741	164,201	150,561	509,439	476,586
Total grain...do....	499,280	286,179	925,994	668,439	6,968,831	2,879,396	1,198,712	551,481	616,757	518,576
Grain products—										
Macaroni, vermicelli, etc., pounds	87,720,730	3,479,824	97,233,708	4,009,995	85,114,003	3,676,786	113,772,801	4,926,812	114,779,116	4,864,318
Malt...bushels..	3,362	3,917	2,625	3,090	1,592	1,992	(1)	(1)	777	996
Meal and flour—										
Oatmeal...pounds..	301,266	15,581	344,003	19,876	444,801	24,612	....	(3)	....	(3)
Wheat flour...barrels..	47,702	159,046	39,593	179,295	92,413	446,500	144,759	681,944	141,582	625,287
Total meal and flour	....	174,627	....	199,171	....	471,112	....	681,944	....	625,287
Other	....	520,256	....	685,774	....	1,031,030	....	1,349,817	....	1,728,702
Total grain products	....	4,178,624	....	4,898,030	....	5,180,920	....	6,958,573	....	7,219,303
Total grain and grain products	....	4,464,803	....	5,566,469	....	8,060,316	....	7,510,054	....	7,737,879
Hay...tons..	61,116	501,507	10,063	89,808	6,712	60,854	96,829	775,916	336,757	2,544,058
Hops...pounds..	6,211,893	1,974,900	8,493,265	1,989,261	7,386,574	1,337,099	3,200,560	1,499,354	8,557,531	2,706,600
Indigo...do....	7,170,057	1,233,541	6,078,073	1,058,354	8,249,972	1,400,286	7,538,689	1,195,942	6,908,751	1,152,518
Licorice root...do....	66,115,863	1,140,541	109,355,720	1,864,436	97,742,776	1,628,894	82,207,496	1,365,077	125,135,490	2,060,235
Liquors, alcoholic:										
Distilled spirits—										
Of domestic manufacture, returned...proof gallons..	154,106	162,072	148,298	160,439	134,015	148,776	119,646	124,162	(1)	(1)
Brandy...do....	629,333	1,687,473	592,382	1,523,842	764,244	1,961,170	716,259	1,899,021	409,242	1,018,382
Gin...do....							1,240,662	1,015,035	1,045,815	994,050
Whisky...do....	3,270,226	5,037,146	3,216,228	4,876,325	3,889,066	5,566,879	1,060,300	2,167,064	1,293,692	2,668,749
Other...do....							1,245,308	1,907,941	925,601	1,395,748
Total distilled spirits, proof gallons	4,053,665	6,886,691	3,956,908	6,560,606	4,787,325	7,676,825	4,382,175	7,113,223	3,674,350	6,076,929

[1] Not stated. [2] Included in "Other," fresh or dried fruits. [3] Included in "Other," grain products.

Agricultural imports of the United States during the five years ending June 30, 1911—Continued.

Article imported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Liquors, alcoholic—Continued.										
Malt liquors—										
Bottled...............gallons..	2,041,688	$1,902,655	1,960,333	$1,829,917	1,801,043	$1,695,747	1,727,541	$1,605,919	1,954,092	$1,790,492
Unbottled..............do....	5,165,929	1,506,108	5,564,773	1,634,754	5,105,062	1,519,660	5,560,491	1,658,034	5,339,800	1,605,874
Total malt liquors.....do....	7,207,617	3,408,763	7,525,106	3,464,671	6,906,105	3,215,407	7,288,032	3,263,953	7,293,892	3,396,366
Wines—										
Champagne and other sparkling..........dozen quarts..	419,403	6,228,281	366,669	5,221,070	436,628	6,863,785	391,022	6,302,702	218,495	3,566,824
Still wines—										
Bottled..................do....	636,938	2,614,346	628,428	2,516,461	650,861	2,574,596	822,266	3,177,140	596,529	2,326,763
Unbottled............gallons..	5,213,458	2,966,154	5,443,782	3,008,996	5,747,056	2,838,232	7,100,669	3,527,918	4,812,787	2,638,039
Total still wines............	....	5,580,500	....	5,525,457	....	5,412,828	....	6,705,058	....	4,964,802
Total wines................	....	11,808,781	....	10,746,527	....	12,276,613	....	13,007,760	....	8,531,626
Total alcoholic liquors.......	....	22,104,235	....	20,771,804	....	23,168,845	....	23,384,936	....	18,004,921
Malt, barley. (*See* Grain and grain products.)										
Malt extract, fluid or solid............	....	3,163	....	21,227	....	4,450	....	(1)	....	16,295
Malt liquors. (*See* Liquors, alcoholic.)										
Nursery stock:										
Plants, trees, shrubs, and vines—										
Fruit plants, tropical and semi-tropical, for propagation, etc..	....	11,328	....	1,912	....	4,001	....	11,914	....	18,962
Orchids, palms, dracænas, crotons, azaleas, tulips, and other bulbs, bulbous roots or corms, cultivated for their flowers...	....	1,841,206	....	2,003,973	....	954,399	....	1,242,773	....	1,642,274
Other........................					....	988,507	....	1,106,977	....	1,094,637
Total nursery stock.........	....	1,852,534	....	2,005,885	....	1,946,907	....	2,361,664	....	2,755,873

Nuts:										
Almonds.................pounds..	14,233,613	2,331,816	17,144,968	2,410,648	11,029,421	1,852,523	18,556,356	3,153,645	15,522,712	2,896,573
Coconuts..........................	....	1,349,562	....	1,439,770	....	1,252,594	....	1,295,854	....	1,704,105
Coconut meat, broken, or copra, pounds..........................	7,064,532	302,132	14,121,570	481,232	23,842,522	666,820	21,306,219	762,560	37,817,051	1,536,718
Cream and Brazil.........bushels..	252,538	650,488	310,420	754,155	407,719	761,219	461,496	1,251,738	283,902	804,064
Filberts..................pounds..	....	(2)	....	(2)	....	(2)	11,593,600	792,466	13,957,940	1,064,772
Palm, and palm nut kernels........	....	38,962	....	2,277	....	4,079	....	(2)	....	(2)
Peanuts..................pounds..	....	(2)	....	(2)	....	(2)	29,276,235	1,234,088	18,834,441	765,033
Walnuts.......................do....	32,597,592	2,969,649	28,887,110	2,765,486	26,157,703	2,409,644	33,641,466	3,538,264	33,619,434	4,471,227
Other..............................	....	2,100,274	....	1,790,375	....	1,717,374	....	1,218,127	....	1,255,921
Total nuts..................	....	9,742,883	....	9,643,943	....	8,664,253	....	13,246,742	....	14,498,413
Oil cake......................pounds..	512,654	5,342	2,848,291	27,513	1,742,727	18,456	5,208,376	59,698	12,405,660	139,332
Oils, vegetable:										
Fixed or expressed—										
Cocoa butter or butterine, pounds..........................	....	(3)	....	(3)	....	(3)	3,369,528	679,871	4,278,896	1,090,818
Coconut oil...........pounds..	35,544,356	2,623,974	45,422,575	3,267,585	52,490,558	3,079,682	48,345,672	3,341,409	51,118,317	4,144,444
Hemp and rape seed...gallons..	....	(3)	....	(3)	....	(3)	1,082,775	464,742	1,362,985	599,047
Nut oil, or oil of nuts, n. e. s., gallons..........................	2,453,597	1,040,722	1,869,120	882,983	2,912,965	1,158,132	5,759,683	2,440,010	7,042,057	2,917,067
Olive, for mechanical purposes, gallons..........................	1,471,766	682,656	1,565,253	703,829	369,979	183,983	842,926	477,679	578,477	378,819
Olive, salad...........gallons..	3,449,517	3,523,725	3,799,112	3,876,901	4,129,454	5,069,655	3,702,210	4,869,114	4,405,827	6,014,191
Palm oil...............pounds..	29,656,207	1,893,285	30,614,875	1,849,611	58,976,379	3,185,038	92,771,868	5,590,535	57,100,406	4,102,916
Other..........................	....	1,925,300	....	1,788,150	....	1,945,080	....	2,952,273	....	7,885,041
Total fixed or expressed......	....	11,689,662	....	12,369,059	....	14,621,570	....	20,815,633	....	27,132,343
Volatile or essential—										
Lemon...............pounds..	....	3,702,220	....	3,645,441	....	2,932,512	415,501	309,383	430,458	322,727
Other..........................							....	1,857,944	....	2,260,679
Total volatile or essential.....	....	3,702,220	....	3,645,441	....	2,932,512	....	2,167,327	....	2,583,406
Total vegetable oils..........	....	15,391,882	....	16,014,500	....	17,554,082	....	22,982,960	....	29,715,749
Opium, crude................pounds..	565,252	1,482,649	285,845	1,151,207	517,388	1,951,518	449,239	1,622,475	629,842	2,208,445
Rice, rice meal, etc.:										
Rice.........................do....	71,287,151	2,118,147	87,619,202	2,543,417	88,780,442	2,361,310	82,662,162	2,112,032	76,657,974	2,126,822
Rice flour, rice meal, and broken rice....................pounds..	138,316,029	2,273,999	125,164,190	2,255,136	134,119,980	2,336,723	142,738,383	2,249,205	132,116,821	1,998,056
Total rice, etc.........do....	209,603,180	4,392,146	212,783,392	4,798,553	222,900,422	4,698,033	225,400,545	4,361,237	208,774,795	4,124,878

1 Not stated.

2 Included in "Other," nuts.

3 Included in "Other," fixed or expressed.

Agricultural imports of the United States during the five years ending June 30, 1911—Continued.

Article imported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Sago, tapioca, etc.	....	$1,432,082	....	$1,574,835	....	$1,396,090	....	$990,525	....	$1,590,971
Seeds:										
Castor beans or seeds.....bushels..	....	(1)	....	(1)	....	(1)	726,002	831,056	745,035	947,782
Clover.....do....	22,849,115	2,385,734	20,659,396	2,323,699	13,786,451	1,202,758	13,069,830	1,472,588	25,357,826	3,046,276
Flaxseed, or linseed.....do....	90,356	124,494	57,419	71,625	593,668	831,871	5,002,496	8,548,837	10,499,227	21,379,180
Sugar beet.....pounds..	....	(1)	....	(1)	....	(1)	10,308,666	668,312	10,988,617	724,592
Other	....	3,894,548	....	3,976,146	....	3,923,390	....	3,172,983	....	3,660,125
Total seeds	....	6,404,776	....	6,371,470	....	5,958,019	....	14,693,776	....	29,757,955
Spices:										
Unground—										
Nutmegs.....pounds..	2,375,139	321,719	2,042,396	236,787	2,645,079	219,286	(2)	(2)	(2)	(2)
Pepper, black or white, pounds	24,320,865	2,232,774	20,335,693	1,532,901	37,094,824	2,115,413	15,488,848	1,102,104	22,065,074	1,622,311
Other.....pounds..	20,374,842	1,838,512	14,332,230	1,194,798	30,497,704	2,114,920	21,862,111	1,660,843	28,140,552	2,383,497
Total unground.....do....	47,070,846	4,393,005	36,710,319	2,964,486	70,237,607	4,449,619	37,350,959	2,762,947	50,205,626	4,005,808
Ground.....do....	6,490,048	719,995	5,414,493	627,051	7,964,336	898,987	6,442,199	720,512	8,017,286	940,392
Total spices.....do....	53,560,894	5,113,000	42,124,812	3,591,537	78,201,943	5,348,606	43,793,158	3,483,459	58,222,912	4,946,200
Spirits, distilled. (*See* Liquors, alcoholic.)										
Starch.....pounds..	6,330,493	152,020	5,284,050	138,166	17,301,351	424,089	10,861,310	296,030	7,938,730	222,470
Straw and grass.....tons..	1,497	6,147	1,462	7,659	2,054	12,098	6,762	32,367	4,287	18,659
Sugar and molasses:										
Molasses.....gallons..	24,630,935	919,806	18,882,756	721,867	22,092,696	937,791	31,292,165	1,367,362	23,838,190	995,006
Sugar—										
Raw—										
Beet.....pounds..	397,745,046	8,203,309	221,036,900	5,401,378	98,625,908	2,521,798	1,148	43	24,669,287	593,037
Cane.....do....	3,986,510,021	84,273,071	3,144,022,423	74,509,970	4,084,921,078	93,768,598	4,088,437,524	106,075,846	3,909,106,213	95,889,959
Total raw.....do....	4,384,255,067	92,476,380	3,365,059,323	79,911,348	4,183,546,986	96,290,396	4,088,438,672	106,075,889	3,933,775,500	96,482,996
Refined.....do....	7,584,908	329,873	6,937,789	346,799	5,874,032	264,602	6,107,264	273,116	4,202,765	208,100
Total sugar.....do....	4,391,839,975	92,806,253	3,371,997,112	80,258,147	4,189,421,018	96,554,998	4,094,545,936	106,349,005	3,937,978,265	96,691,096

Total sugar and molasses	....	93,726,059	....	80,980,014	....	97,492,789	....	107,716,367	....	97,686,102
Sugar-beet pulp...pounds	(3)	(3)	(3)	(3)	1,556,467	12,871	3,405,500	27,228	2,685,440	22,156
Tea...do	86,368,490	13,915,544	94,149,564	16,309,870	114,916,520	18,562,676	85,626,370	13,671,946	102,653,942	17,613,569
Tea, waste, etc., for manufacturing, pounds	(3)	(3)	(3)	(3)	1,920,918	59,317	3,229,221	96,122	3,736,789	94,302
Teazels	....	9,756	....	10,509	....	8,412	....	(3)	....	4,401
Tobacco:										
Leaf—										
Wrapper...pounds	7,576,325	8,617,575	5,943,714	6,312,023	5,648,178	5,342,634	6,647,948	6,483,555	5,956,776	6,420,298
Filler and other leaf...do	31,963,996	17,437,673	26,112,329	16,558,305	36,087,920	20,058,285	40,205,441	21,270,003	39,976,129	21,437,003
Stems...do	1,358,486	4,737	2,949,088	14,203	1,387,098	4,854	(3)	(3)	2,270,383	8,264
Total tobacco...do	40,898,807	26,059,985	35,005,131	22,884,531	43,123,196	25,405,773	46,853,389	27,753,558	48,203,288	27,865,565
Vanilla beans...pounds	969,249	1,523,156	571,977	1,170,135	1,121,485	1,495,469	797,409	1,203,773	1,140,650	1,953,372
Vegetables:										
Fresh or dried—										
Beans [4]...bushels	406,679	656,898	1,657,401	2,406,935	3,355,405	4,926,199	1,015,157	1,621,207	1,037,371	1,733,697
Onions...do	1,126,114	926,115	1,275,333	866,663	574,530	412,127	1,024,226	769,539	1,514,967	1,078,201
Potatoes...do	176,917	192,635	403,952	283,032	8,383,966	3,677,034	353,208	306,815	218,984	235,847
Other	....	1,024,262	....	1,138,429	....	1,104,036	....	1,857,846	....	2,554,889
Total fresh or dried	....	2,799,910	....	4,695,059	....	10,119,396	....	4,555,407	....	5,602,634
Prepared or preserved—										
Mushrooms...pounds	....	(5)	....	(5)	....	(5)	7,038,127	940,382	6,656,957	860,884
Pickles and sauces	....	934,803	....	816,245	....	796,842	....	935,609	....	886,304
Other	....	1,993,759	....	2,777,764	....	2,083,559	....	1,841,973	....	1,944,033
Total prepared or preserved	....	2,928,562	....	3,594,009	....	2,880,401	....	3,717,964	....	3,691,221
Total vegetables	....	5,728,472	....	8,289,068	....	12,999,797	....	8,273,371	....	9,293,855
Vinegar...gallons	230,072	65,282	204,213	56,671	280,033	71,867	301,030	78,577	302,898	75,816
Wafers, unmedicated	....	26,617	....	28,016	....	25,316	....	36,922	....	32,173
Wax, vegetable...pounds	(3)	(3)	(3)	(3)	(3)	(3)	5,241,087	823,053	4,281,596	838,405
Wines. (*See* Liquors, alcoholic.)										
Total vegetable matter, including forest products	....	524,790,288	....	467,033,735	....	527,277,381	....	595,357,986	....	633,595,218
Total vegetable matter, excluding forest products	....	402,369,512	....	369,300,643	....	403,357,255	....	416,486,189	....	471,283,653
Total agricultural imports, including forest products	....	749,257,584	....	637,423,213	....	762,532,818	....	866,380,912	....	842,516,497
Total agricultural imports, excluding forest products	....	626,836,808	....	539,690,121	....	638,612,692	....	687,509,115	....	680,204,932

[1] Included in "Other" seeds.
[2] Included in "Other" spices, unground.
[3] Not stated.
[4] Prior to July 1, 1909, including "Dried peas."
[5] Included in "Other" vegetables, prepared or preserved.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1911.

Article exported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER.										
Animals, live:										
Cattle........number..	423,051	$34,577,392	349,210	$29,339,134	207,542	$18,046,976	139,430	$12,200,154	150,100	$13,163,920
Fowls........		([1])		151,925		115,946		137,619		([1])
Horses........number..	33,882	4,359,957	19,000	2,612,587	21,616	3,386,617	28,910	4,081,157	25,145	3,845,253
Mules........do....	6,781	850,901	6,609	990,667	3,432	472,017	4,512	614,094	6,585	1,070,051
Sheep........do....	135,344	750,242	101,000	589,285	67,656	365,155	44,517	209,000	121,491	636,272
Swine........do....	24,262	309,440	30,818	307,202	18,655	144,605	4,410	46,955	8,551	74,032
Other........		[2] 355,148		110,489		114,122		158,756		[2] 259,125
Total live animals........		41,203,080		34,101,289		22,645,438		17,447,735		19,048,653
Beeswax........pounds..	117,169	36,392	90,506	28,659	77,547	23,293	89,890	27,740	101,735	31,404
Dairy products:										
Butter........do....	12,544,777	2,429,489	6,463,061	1,407,962	5,981,265	1,268,210	3,140,545	785,771	4,877,797	1,059,432
Cheese........do....	17,285,230	2,012,626	8,439,031	1,092,053	6,822,842	857,091	2,846,709	441,017	10,366,605	1,288,279
Milk........do....	([3])	2,191,111	([3])	2,455,186	([3])	1,375,104	13,311,318	1,023,633	12,180,445	936,105
Total dairy products...do....	([3])	6,633,226	([3])	4,955,201	([3])	3,500,405	19,298,572	2,250,421	27,424,847	3,283,816
Eggs........dozens..	6,968,985	1,542,789	7,590,977	1,540,014	5,207,151	1,199,522	5,325,936	1,260,486	8,558,712	1,787,019
Egg yolks........		11,565		9,024		23,938		3,585		5,353
Feathers........		316,306		389,556		400,045		312,784		250,906
Fibers, animal:										
Silk waste........pounds..	129,078	37,709	198,736	49,881	300,553	77,944	266,207	64,528	119,801	30,863
Wool........do....	214,840	48,820	182,458	42,104	28,376	4,668	47,520	10,077	([3])	([3])
Total animal fibers....do....	343,918	86,529	381,194	91,985	328,929	82,612	313,727	74,605	119,801	30,863
Glue........do....	3,481,715	331,998	2,917,173	289,441	2,340,426	244,751	2,488,205	261,756	2,307,966	242,755
Honey........		93,690		78,102		85,578		159,401		81,649
Packing-house products:										
Beef—										
Canned........pounds..	15,809,826	1,615,808	23,376,447	2,467,875	14,895,527	1,645,822	14,804,596	1,678,452	10,824,504	1,254,979

Cured—										
Salted or pickled.....do....	62,645,281	3,740,212	46,958,367	3,213,480	44,494,210	3,438,048	36,554,266	2,744,886	40,283,749	3,501,179
Other...............do....	1,053,287	107,956	937,720	106,470	294,853	34,319	317,047	38,815		
Total cured........do....	63,698,568	3,848,168	47,896,087	3,319,950	44,789,063	3,472,367	36,871,313	2,783,701	40,283,749	3,501,179
Fresh...................do....	281,651,502	26,367,287	201,154,105	20,339,377	122,952,671	12,698,594	75,729,666	7,733,751	42,510,731	4,478,401
Oils—Oleo oil [4]..........do....	195,337,176	16,819,933	212,541,157	19,278,476	179,985,246	19,126,741	126,091,675	14,305,080	138,696,906	13,658,762
Oleomargarine...........do....	5,397,609	520,406	2,938,175	299,746	2,889,058	293,635	3,418,632	349,972	3,794,939	408,459
Tallow...................do....	127,857,739	7,182,688	91,397,507	5,399,219	53,332,767	3,000,366	29,379,992	1,779,615	29,813,154	1,933,681
Total beef.............do....	689,752,420	56,354,290	579,303,478	51,104,643	418,844,332	40,237,525	286,295,874	28,630,571	265,923,983	25,235,461
Bones, hoofs, horns, and horn tips, strips and waste..................	....	172,208	....	245,628	....	232,628	....	150,371	....	152,167
Bristles..............................	....	2,732	....	410	....	(3)	....	(3)	....	(3)
Grease, grease scraps, and all soap stock..............................	....	5,473,623	....	5,762,709	....	4,814,901	....	4,612,426	....	5,177,581
Hair....................................	....	938,433	....	1,165,475	....	988,749	....	1,142,845	....	1,274,345
Hides and skins, other than furs, pounds..............................	15,396,806	1,760,032	14,650,454	1,536,225	12,858,975	1,271,190	14,635,075	1,738,216	44,594,235	4,802,637
Lard compounds.........pounds..	80,148,861	6,166,910	75,183,210	6,035,418	75,183 196	6,115,307	74,556,603	6,887,738	73,754,400	7,070,967
Meat, canned, n. e. s................	....	745,247	....	1,265,283	....	1,060,222	....	1,030,031	....	1,180,123
Mutton...................pounds..	822,998	83,874	1,185,040	117,688	1,498,674	141,654	1,989,472	213,477	2,160,259	219,517
Oils, animal, n. e. s. ......gallons..	503,234	292,381	621,300	341,304	614,383	343,838	535,875	401,460	1,019,478	681,096
Pork—										
Canned...............pounds..	2,710,369	287,460	4,957,022	532,442	5,759,930	620,193	4,062,022	459,843	4,010,862	483,959
Cured—										
Bacon...............do....	250,418,699	26,470,972	241,189,929	25,481,246	244,578,674	25,920,490	152,163,107	18,381,050	156,675,310	21,211,605
Hams and shoulders..do....	209,481,496	23,698,207	221,769,634	25,167,059	212,170,224	23,526,307	146,885,385	17,837,375	157,709,316	20,708,882
Salted or pickled.....do....	166,427,409	15,167,058	149,505,937	13,332,654	52,354,980	4,599,431	40,031,599	4,421,844	45,729,471	4,944,448
Total cured........do....	626,327,604	65,336,237	612,465,500	63,980,959	509,103,878	54,046,228	339,080,091	40,640,269	360,114,097	46,864,935
Fresh....................do....	11,467,779	1,143,886	16,374,468	1,551,450	9,555,315	938,025	1,040,278	126,888	1,355,378	159,654
Lard.....................do....	627,559,660	57,497,980	603,413,770	54,789,748	528,722,933	52,712,569	362,927,671	43,301,156	476,107,857	52,509,217
Lard, neutral............do....	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	37,866,812	4,134,294
Oils—Lard oil.........gallons..	234,730	144,063	259,062	169,625	234,626	167,644	151,142	131,241	120,094	90,724
Total pork.................	....	124,409,626	....	121,024,224	....	108,484,659	....	84,659,397	....	104,242,783
Sausage and sausage meat.pounds..	8,000,973	925,877	8,367,495	969,472	8,538,058	997,655	5,072,255	627,669	4,716,610	601,596
Sausage casings..............do....	(3)	3,422,271	(3)	3,959,384	(3)	3,520,191	35,418,957	4,503,339	40,013,760	5,466,661
All other..............................	....	2,708,632	....	2,659,228	....	1,783,331	....	1,361,833	....	1,197,732
Total packing-house products	....	203,456,136	....	196,187,091	....	169,991,850	....	135,959,373	....	157,302,666

[1] Included in "Other" live animals.
[2] Including "Fowls."
[3] Not stated.
[4] Prior to July 1, 1910, including "Lard, neutral."
[5] Included in "Oleo oil".

Agricultural exports (domestic) of the United States during the five years ending June 30, 1911—Continued.

Article exported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER—continued.										
Poultry and game		$1,086,618		$881,792		$848,644		$599,548		$981,805
Silk waste. (*See* Fibers, animal.)										
Wool. (*See* Fibers, animal.)										
Total animal matter		254,798,329		238,552,154		199,046,076		158,357,434		183,046,889
VEGETABLE MATTER.										
Breadstuffs. (*See* Grain and grain products.)										
Broom corn		268,812		266,696		304,522		424,484		363,644
Cider ... gallons	197,514	30,681	172,617	26,401	87,630	14,121	5,784	1,965	22,708	8,791
Cocoa, ground or prepared, and chocolate		376,467		403,509		471,458		471,358		498,694
Coffee:										
Green or raw ... pounds	38,771,906	4,692,137	35,356,109	4,314,020	28,630,278	3,729,840	45,514,438	5,703,786	34,853,601	5,107,949
Roasted or prepared ... do	2,261,517	297,280	4,301,029	474,451	986,100	155,776	1,210,886	196,348	1,484,290	272,532
Total coffee ... do	41,033,423	4,989,417	39,657,138	4,788,471	29,616,378	3,885,616	46,725,324	5,900,134	36,337,891	5,380,481
Cotton:										
Sea Island ... bales	20,173	2,075,446	33,042	3,351,132	25,939	2,035,120	30,201	3,276,441	21,622	2,345,567
Sea Island ... pounds	7,605,804		12,699,567		9,740,806		11,460,277		8,214,847	
Upland ... bales	8,688,296	479,202,351	7,401,538	434,437,070	8,551,789	415,355,545	6,233,092	447,170,802	7,807,414	582,973,302
Upland ... pounds	4,510,611,416		3,804,299,126		4,438,244,396		3,195,247,949		4,025,726,068	
Total cotton ... do	4,518,217,220	481,277,797	3,816,998,693	437,788,202	4,447,985,202	417,390,665	3,206,708,226	450,447,243	4,033,940,915	585,318,869
Flavoring extracts and fruit juices		48,491		52,395		64,418		84,856		136,354
Flowers, cut		2,579		1,784		4,433		10,585		24,676
Forest products:										
Bark, and extract of, for tanning—										
Bark ... pounds	2,322,130	29,975	3,987,330	57,515	3,845,690	56,572	1,210,305	18,291	1,654,439	19,935
Bark, extracts of		305,998		241,608		260,965		388,448		336,600
Total bark, etc.		335,973		299,123		317,537		406,739		356,535
Charcoal		7,956		4,271		13,360		25,310		27,317

Moss		40,578		33,742		39,284		41,243		51,445
Naval stores—										
Rosin .... barrels	2,560,966	11,327,091	2,712,732	11,395,126	2,170,177	8,004,838	2,144,318	9,753,488	2,189,607	14,067,335
Tar .... do	16,792	57,215	14,691	53,983	11,072	46,442	40,037	148,238	40,380	187,183
Turpentine and pitch .... do	19,830	60,563	13,448	46,339	10,034	31,809				
Turpentine, spirits of .... gallons	15,854,676	10,241,883	19,532,583	10,146,151	17,502,028	7,018,058	15,587,737	8,780,236	14,817,751	10,768,202
Total naval stores		21,686,752		21,641,599		15,101,147		18,681,962		25,022,720
Wood—										
Logs [1]		3,645,180		4,337,766		2,846,863		3,432,635		4,278,249
Lumber—										
Boards, deals, and planks, M feet	1,623,964	39,861,352	1,548,130	35,607,508	1,357,822	29,056,579	1,684,489	36,774,219	2,031,608	43,756,177
Joists and scantling. M feet	34,851	752,152	27,332	581,718	22,122	378,914	26,272	507,853	29,357	520,358
Shingles .... M	18,256	53,261	20,483	75,535	14,104	61,784	17,292	53,371	32,308	94,339
Shooks—										
Box		939,724		958,127		957,682		1,121,613		1,109,646
Other .... number	803,346	1,409,595	900,812	1,716,190	977,376	1,962,199	928,197	1,654,611	1,019,411	1,662,032
Total shooks		2,349,319		2,674,317		2,919,881		2,776,224		2,771,678
Staves and heading—										
Heading		157,553		176,430		154,766		223,038		388,369
Staves .... number	51,120,171	5,127,522	61,696,949	6,016,690	52,583,016	5,524,199	49,783,771	4,673,085	65,725,595	5,666,854
Total staves and heading		5,285,075		6,193,120		5,678,965		4,896,123		6,055,223
Other		3,578,452		5,216,854		5,461,866		5,355,245		6,328,902
Total lumber		51,879,611		50,349,052		43,557,989		50,363,035		59,526,677
Timber—										
Hewn .... cubic feet	3,278,110	890,106	4,883,506	1,316,465	2,950,528	839,011	3,245,196	825,192	2,673,887	770,123
Sawed .... M feet	600,865	13,101,178	463,440	11,040,677	383,309	8,414,519	451,721	9,852,027	499,547	11,476,732
Total timber		13,991,284		12,357,142		9,253,530		10,677,219		12,246,855
All other, including firewood		(2)		(2)		479,996		460,210		275,870
Total wood		69,516,075		67,043,960		56,138,378		64,933,099		76,327,651
Wood alcohol .... proof galls	2,150,311	862,819	1,958,630	819,753	1,100,495	383,788	1,328,601	581,820	1,962,336	881,991
Wood pulp .... pounds	25,079,946	498,552	23,845,732	519,625	20,650,756	448,960	17,297,389	360,057	18,067,409	371,233
Total forest products		92,948,705		90,362,073		72,442,454		85,030,230		103,038,892

[1] Prior to July 1, 1908, including firewood and other unmanufactured wood.

[2] Included in "Logs."

Agricultural exports (domestic) of the United States during the five years ending June 30, 1911—Continued.

Article exported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Fruits:										
Fresh or dried—										
Apples, dried.........pounds..	45,697,948	$3,166,946	24,237,873	$1,946,810	33,474,634	$2,339,936	25,076,618	$2,056,692	21,804,086	$1,944,209
Apples, fresh..........barrels..	1,539,267	4,652,966	1,049,545	3,660,854	896,279	2,782,007	922,078	3,175,433	1,721,106	5,777,458
Apricots, dried.......pounds..	2,760,432	336,812	1,224,602	229,467	16,597,871	1,512,417	12,028,834	1,218,423	19,329,358	2,085,437
Oranges................boxes..	(1)	1,255,104	654,251	1,577,661	866,753	2,131,724	932,118	2,213,905	1,179,273	2,983,322
Peaches, dried........pounds..	1,757,650	186,043	1,148,598	144,318	2,403,430	151,334	2,617,069	151,520	7,125,014	499,530
Pears, fresh................	....	675,944	....	288,918	....	546,198	....	302,958	....	578,067
Prunes...............pounds..	44,400,104	2,400,960	28,148,450	1,642,114	22,602,288	1,078,210	89,014,880	4,016,554	51,030,711	3,271,971
Raisins..................do....	9,128,827	599,398	5,684,541	427,583	7,880,161	455,657	8,526,114	417,403	18,659,992	1,069,300
Other........................	....	2,246,384	....	2,360,360	....	2,104,624	....	2,119,210	....	2,792,281
Total fresh or dried..........	....	15,520,557	....	12,278,085	....	13,102,107	....	15,672,098	....	21,001,575
Preserved—										
Canned........................	....	1,581,047	....	1,549,826	....	2,899,374	....	2,656,019	....	2,686,445
Other..........................	....	104,663	....	137,929	....	77,746	....	176,474	....	205,643
Total preserved.............	....	1,685,710	....	1,687,755	....	2,977,120	....	2,832,493	....	2,892,088
Total fruits.................	....	17,206,267	....	13,965,840	....	16,079,227	....	18,504,591	....	23,893,663
Ginseng.....................pounds..	117,696	813,023	154,180	1,111,994	186,257	1,270,179	192,406	1,439,434	153,999	1,088,202
Glucose and grape sugar:										
Glucose......................do....	151,629,441	3,017,527	98,608,192	1,898,652	92,652,409	1,938,406	112,730,639	2,623,131	137,461,782	2,596,220
Grape sugar.................do....			31,078,642	641,988	19,572,095	407,683	37,089,449	792,089	44,501,264	799,163
Grain and grain products:										
Grain—										
Barley...............bushels..	8,238,842	4,556,295	4,349,078	3,205,528	6,580,393	4,672,166	4,311,566	3,052,527	9,399,346	5,381,360
Buckwheat..............do....	199,429	128,837	116,127	94,638	186,702	137,413	158,160	103,138	223	186
Corn.......................do....	83,300,708	44,261,816	52,445,800	33,942,197	35,853,412	25,194,466	36,802,374	25,427,993	63,761,458	35,961,479
Oats.......................do....	4,014,042	1,670,881	1,158,622	624,569	1,510,320	804,759	1,685,474	794,367	2,044,912	832,718
Rye.........................do....	749,455	562,016	2,419,958	2,184,335	1,272,559	1,049,809	219,756	168,666	2,623	2,503
Wheat.....................do....	76,569,423	60,214,388	100,371,057	99,736,767	66,923,244	68,094,447	46,679,876	47,806,598	23,729,302	22,040,273
Total grain............do....	173,071,899	111,394,233	160,860,642	139,788,034	112,326,630	99,953,060	89,857,206	77,353,289	98,937,864	64,218,519

Grain products—										
Bran, middlings, and mill feed, tons	92,675	2,115,848	116,917	3,004,174	45,737	1,222,406	53,548	1,521,622	67,687	1,895,555
Breadstuffs preparations—										
Bread and biscuit . pounds	11,886,745	696,025	13,052,074	766,170	12,606,614	710,687	13,064,688	767,151	14,022,092	800,068
Other	....	1,942,238	....	1,885,915	....	1,858,646	....	2,040,314	....	2,362,559
Total breadstuff preparations	....	2,638,263	....	2,652,085	....	2,569,333	....	2,807,465	....	3,162,627
Distillers' and brewers' grains and malt sprouts . . . tons	84,581	1,617,850	65,682	1,424,677	75,503	1,758,404	65,497	1,640,401	76,803	1,914,218
Malt . . . bushels	414,515	278,448	224,991	201,554	163,230	147,258	156,497	129,088	117,882	103,099
Meal and flour—										
Corn meal . . . barrels	766,880	2,313,410	654,515	2,053,447	452,907	1,549,010	331,531	1,147,568	463,266	1,456,683
Oatmeal . . . pounds	42,701,257	1,122,162	24,484,199	705,853	14,822,944	516,524	15,538,535	521,658	32,416,892	1,043,867
Rye flour . . . barrels	3,377	10,879	4,105	16,521	3,857	14,600	3,751	15,240	6,250	24,182
Wheat flour . . . do	15,584,667	62,175,397	13,927,247	64,170,508	10,521,161	51,157,366	9,040,987	47,621,467	10,129,435	49,386,946
Total meal and flour	....	65,621,848	....	66,946,329	....	53,237,500	....	49,305,933	....	51,911,678
All other	....	732,660	....	1,445,289	....	1,188,518	....	562,620	....	1,057,140
Total grain products	....	73,004,917	....	75,674,108	....	60,123,419	....	55,967,129	....	60,044,317
Total grain and grain products	....	184,399,150	....	215,462,142	....	160,076,479	....	133,320,418	....	124,262,836
Grasses, dried	....	11,670	....	1,206	....	(1)	....	(1)	....	(1)
Hay . . . tons	58,602	976,287	77,281	1,463,010	64,641	1,147,753	55,007	1,070,907	55,223	1,032,591
Hops . . . pounds	16,809,534	3,531,972	22,920,480	2,963,167	10,446,884	1,271,629	10,589,254	2,062,140	13,104,774	2,130,972
Lard compounds. (*See* Meat and meat products.)										
Liquors, alcoholic:										
Distilled spirits—										
Alcohol, including cologne spirits . . . proof gallons	428,107	70,814	235,752	53,793	103,932	36,719	231,077	64,393	35,231	19,820
Brandy . . . do	14,172	22,496	2,750	4,900	14,718	12,262	(2)	(2)	(2)	(2)
Rum . . . do	914,074	1,191,418	938,331	1,232,179	926,049	1,237,118	1,138,128	1,474,761	1,129,578	1,476,147
Whisky—										
Bourbon . . . do	190,067	253,222	129,258	160,914	331,909	365,446	46,301	80,213	58,459	86,714
Rye . . . do	134,110	252,918	172,755	320,935	121,320	210,031	182,002	301,044	133,450	251,453
Total whisky . . . do	324,177	506,140	302,013	481,849	453,229	575,477	228,303	381,257	191,909	338,167
Other . . . do	19,779	36,889	28,391	43,566	11,204	22,391	38,122	57,595	42,246	51,357
Total distilled spirits . . do	1,700,309	1,827,757	1,507,237	1,816,287	1,509,132	1,883,967	1,635,630	1,978,006	1,398,964	1,885,491

[1] Not stated.

[2] Included in "Other," distilled spirits.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1911—Continued.

Article exported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Liquors, alcoholic—Continued.										
Malt liquors—										
Bottled.........dozen quarts..	743,163	$1,128,226	643,230	$964,207	635,361	$964,992	596,883	$877,324	689,093	$990,395
Unbottled............gallons..	356,788	87,114	272,949	55,965	246,525	45,795	390,477	73,859	451,694	85,164
Total malt liquors..........	....	1,215,340	....	1,020,172	....	1,010,787	....	951,183	....	1,075,559
Wines—										
Bottled.........dozen quarts..	4,404	20,128	6,273	30,830	3,839	19,902	5,962	31,314	[1] 1,394,994	518,536
Unbottled............gallons..	560,147	251,353	438,676	195,160	415,891	181,516	501,348	193,597		
Total wines...............	....	271,481	....	225,990	....	201,418	....	224,911	[1] 1,394,994	518,536
Total alcoholic liquors.......	....	3,314,578	....	3,062,449	....	3,096,172	....	3,154,100	....	3,479,586
Malt. (*See* Grain and grain products.)										
Malt liquors. (*See* Liquors, alcoholic.)										
Malt sprouts. (*See* Grain and grain products.)										
Nursery stock......................	....	225,339	....	247,844	....	317,827	....	324,136	....	337,988
Nuts:										
Peanuts.................pounds..	6,386,012	278,236	5,503,685	283,819	5,501,107	242,569	4,484,613	224,779	5,447,185	276,651
Other........................	....	103,929	....	89,205	....	246,284	....	156,284	....	328,151
Total nuts................	....	382,165	....	373,024	....	488,853	....	381,063	....	604,802
Oil cake and oil-cake meal:										
Corn....................pounds..	56,808,972	677,156	66,127,704	801,787	53,233,890	727,355	49,108,598	689,633	83,384,870	1,115,986
Cottonseed.................do....	1,340,967,136	17,062,594	929,287,467	11,889,415	1,233,750,327	15,805,433	640,088,766	9,071,815	804,596,955	10,153,475
Flaxseed, or linseed.........do....	665,936,164	8,675,877	696,135,362	9,175,559	682,764,545	9,303,346	652,316,916	9,489,564	559,674,653	8,361,666
Total...............do....	2,063,712,272	26,415,627	1,691,550,533	21,866,761	1,969,748,762	25,836,134	1,341,514,280	19,251,012	1,447,656,478	19,631,127
Oils, vegetable:										
Fixed or expressed—										
Corn..................pounds..	22,809,517	1,083,929	27,444,975	1,456,120	24,441,668	1,293,580	11,299,332	643,392	25,316,799	1,573,605
Cottonseed.............do....	314,102,280	17,074,403	307,649,933	17,226,451	383,154,968	20,851,380	223,955,002	14,798,063	225,520,944	17,127,369
Linseed.............gallons..	450,208	203,712	367,883	172,083	273,029	140,876	228,426	155,858	175,210	164,879

Other	....	430,965	....	206,993	....	249,360	....	343,509	....	292,757
Total fixed or expressed	....	18,793,009	....	19,061,647	....	22,535,196	....	15,940,822	....	19,158,610
Volatile, or essential—										
Peppermint ... pounds	147,722	499,082	141,617	357,555	161,811	288,318	110,407	215,845	123,420	269,034
Other	....	258,423	....	214,765	....	274,536	....	322,634	....	377,588
Total volatile, or essential	....	757,505	....	572,320	....	562,854	....	538,479	....	646,622
Total vegetable oils	....	19,550,514	....	19,633,967	....	23,098,050	....	16,479,301	....	19,805,232
Rice, rice meal, etc.:										
Rice ... pounds	2,443,008	84,681	2,195,947	87,687	1,566,531	60,814	7,049,597	222,244	15,575,271	623,572
Rice bran, meal, and polish, pounds	27,731,363	259,521	26,248,468	236,070	18,944,898	171,589	19,729,591	179,037	14,488,070	130,228
Rice hulls	....	113,071	....	150,011	....	119,279	....	73,249	....	36,811
Total	....	457,273	....	473,768	....	351,682	....	474,530	....	790,611
Root beer ... dozen quarts	1,756	1,846	330	441	(2)	(2)	(2)	(2)	(2)	(2)
Roots, herbs, and barks, n. e. s	....	413,799	....	435,041	....	395,801	....	476,837	....	563,862
Seeds:										
Cottonseed ... pounds	17,628,111	209,493	28,478,473	353,213	51,626,741	632,561	24,931,099	406,120	13,224,347	209,944
Flaxseed, or linseed ... bushels	6,336,310	7,990,383	4,277,313	5,721,337	882,899	1,092,539	65,193	118,329	976	2,520
Grass and clover seed—										
Clover ... pounds	3,989,798	420,104	3,547,747	579,199	16,186,133	1,706,780	6,977,685	832,676	4,359,167	577,929
Timothy ... do	18,616,834	813,224	25,550,134	1,247,960	23,346,614	1,009,557	27,113,056	1,115,526	9,307,428	817,377
Other	....	397,493	....	495,245	....	474,519	....	601,611	....	334,169
Total grass and clover seed	....	1,630,821	....	2,322,404	....	3,190,856	....	2,549,813	....	1,729,475
All other seeds	....	263,912	....	286,734	....	340,667	....	411,156	....	533,127
Total seeds	....	10,094,609	....	8,683,688	....	5,256,623	....	3,485,418	....	2,475,066
Spices	....	50,111	....	43,587	....	38,444	....	52,755	....	58,989
Spirits, distilled. (*See* Liquors, alcoholic.)										
Starch ... pounds	51,334,580	1,126,465	48,125,851	1,142,054	33,228,278	780,155	51,535,570	1,274,773	158,239,178	3,137,552
Straw ... tons	(2)	7,482	(2)	6,552	(2)	8,293	1,087	13,884	922	10,679
Sugar, molasses, and sirup:										
Molasses ... gallons	3,193,322	297,493	3,320,419	425,757	3,973,908	440,225	1,505,355	216,336	3,386,811	354,108
Sirup ... do	14,115,819	2,050,964	13,181,095	1,961,670	13,865,756	2,243,201	13,457,307	2,258,640	12,001,799	1,752,118

2 Gallons.

2 Not stated.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1911—Continued.

Article exported.	1907		1908		1909		1910		1911	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Sugar, molasses, and sirup—Continued.										
Sugar—										
Raw.....pounds..	58,587	$1,812	13,285	$523	60,882	$1,742	54,447	$2,051	(1)	(1)
Refined.....do....	21,179,016	829,350	25,497,358	973,661	79,885,415	2,783,334	125,452,575	5,396,009	54,947,444	$2,244,379
Total sugar.....do....	21,237,603	831,162	25,510,643	974,184	79,946 297	2,785,076	125,507,022	5,398,060	54,947,444	2,244,379
Total sugar, molasses, and sirup.....	.....	3,179,619	.....	3,361,611	.....	5,468,502	.....	7,873,036	.....	4,350,605
Teazels.....	.....	550	.....	2,056	.....	(2)	.....	(2)	.....	(2)
Tobacco:										
Leaf.....pounds..	331,548,309	33,193,881	323,033,034	34,342,293	282,688,917	30,757,931	353,372,672	38,017,260	351,568,138	39,159,708
Stems and trimmings.....do....	9,194,555	183,517	7,779,624	384,864	5,212,029	144,969	3,823,402	98,126	3,758,934	95,612
Total.....do....	340,742,864	33,377,398	330,812,658	34,727,157	287,900,946	30,902,900	357,196,074	38,115,386	355,327,072	39,255,320
Vegetables:										
Fresh or dried—										
Beans and pease.....bushels..	435,490	932,264	306,939	708,201	298,209	702,819	365,721	973,231	288,638	814,663
Onions.....do....	257,747	217,582	174,820	184,166	366,989	318,051	254,255	208,134	234,289	224,037
Potatoes.....do....	1,530,461	1,278,034	1,203,894	1,077,612	763,651	715,701	999,476	759,277	2,383,887	1,535,630
Total fresh or dried.....do....	2,223,698	2,427,880	1,685,653	1,969,979	1,428,849	1,736,571	1,619,452	1,940,642	2,906,814	2,574,330
Prepared or preserved—										
Canned.....	.....	598,628	.....	621,987	.....	728,111	.....	782,973	.....	1,061,259
Other.....	.....	981,325	.....	1,303,328	.....	1,295,784	.....	1,483,704	.....	1,909,502
Total prepared or preserved..	.....	1,579,953	.....	1,925,315	.....	2,023,895	.....	2,266,677	.....	2,970,761
Total vegetables.....	.....	4,007,833	.....	3,895,294	.....	3,760,466	.....	4,207,319	.....	5,545,091
Vinegar.....gallons..	81,752	13,274	109,263	15,841	106,903	15,100	114,747	12,861	130,588	21,876
Wines. (*See* Liquors, alcoholic.)										
Yeast.....	.....	38,465	.....	37,658	.....	50,455	.....	71,245	.....	143,971
Total vegetable matter, including forest products.....	.....	892,555,792	.....	869,206,323	.....	776,634,500	.....	797,831,221	.....	950,786,405

Total vegetable matter, excluding forest products	....	799,607,087	....	778,844,250	....	704,192,046	....	712,800,991	....	847,747,513
Total agricultural exports, including forest products	....	1,147,354,121	....	1,107,758,477	....	975,680,576	....	956,188,655	....	1,133,833,294
Total agricultural exports, excluding forest products	....	1,054,405,416	....	1,017,396,404	....	903,238,122	....	871,158,425	....	1,030,794,402

[1] Included in "Refined," sugar.

[2] Not stated.

Foreign trade of the United States in agricultural products, 1851–1911.

[Compiled from reports of Foreign Commerce and Navigation of the United States. All values are gold.]

Year ending June 30—	Agricultural exports.[1] Domestic. Total.	Agricultural exports.[1] Domestic. Percentage of all domestic exports.	Agricultural exports.[1] Foreign.	Agricultural imports.[1] Total.	Agricultural imports.[1] Percentage of all imports.	Excess of exports (+) or of imports (−), agricultural.
1851	$146,717,431	82.1	$5,084,886	$60,513,449	28.7	+$91,288,868
1852	125,183,749	80.8	5,897,138	61,747,933	29.8	+ 69,332,954
1853	155,461,445	81.9	6,820,517	71,499,465	27.1	+ 90,782,497
1854	172,320,260	80.0	11,528,791	71,720,047	24.1	+112,129,004
1855	149,101,277	77.4	9,601,059	81,726,640	31.7	+ 76,975,696
1856	222,409,001	83.5	6,451,870	102,541,703	33.0	+126,319,168
1857	232,180,205	83.2	8,182,890	133,226,318	38.2	+107,136,777
1858	205,853,748	81.9	13,739,733	102,482,331	38.9	+117,111,150
1859	226,135,020	81.2	9,054,220	126,236,317	38.1	+108,952,923
1860	260,280,413	82.3	10,577,008	129,816,165	36.7	+141,041,256
1861	154,094,839	75.2	9,315,314	113,329,585	39.2	+ 50,080,568
1862	140,463,928	78.2	5,569,056	91,263,088	48.2	+ 54,769,896
1863	137,512,273	73.9	8,162,395	102,886,713	42.3	+ 42,787,955
1864	102,794,359	71.6	9,037,218	138,124,440	43.6	− 26,292,863
1865	84,886,860	62.0	17,876,028	114,031,753	47.8	− 11,268,865
1866	278,670,278	82.6	5,793,649	164,801,739	37.9	+119,662,188
1867	214,258,245	76.6	9,244,181	141,622,826	35.8	+ 81,879,600
1868	206,979,580	76.8	6,709,785	157,638,217	44.1	+ 56,051,148
1869	205,330,174	74.6	7,067,011	185,348,661	44.4	+ 27,048,524
1870	296,962,357	78.9	10,667,193	191,559,361	43.9	+116,070,189
1871	330,034,934	77.0	9,002,337	222,700,936	42.8	+116,336,335
1872	332,936,080	77.7	9,205,158	274,146,298	43.8	+ 67,994,940
1873	396,240,107	78.5	9,574,000	277,604,621	43.2	+128,209,486
1874	453,862,070	79.7	9,629,988	267,414,990	47.1	+196,077,068
1875	389,409,703	78.0	7,406,702	261,618,732	49.1	+135,197,673
1876	410,884,027	78.2	8,450,386	234,993,224	51.0	+184,341,189
1877	435,354,451	73.8	7,296,110	249,281,945	55.2	+193,368,616
1878	531,637,041	78.1	9,419,767	236,112,137	54.0	+304,944,671
1879	557,321,801	79.8	8,079,701	233,623,846	52.4	+331,777,656
1880	694,315,497	84.3	7,173,664	314,617,480	47.1	+386,871,681
1881	738,123,799	83.5	11,189,658	298,283,101	46.4	+451,030,356
1882	557,620,540	76.0	9,857,878	330,375,047	45.6	+237,103,371
1883	626,426,608	77.9	11,282,895	325,757,806	45.0	+311,951,697
1884	547,952,579	75.6	8,749,894	319,053,331	47.8	+237,649,142
1885	554,051,145	76.2	9,077,454	277,340,305	48.0	+285,788,294
1886	501,313,738	75.3	7,734,192	306,011,332	48.2	+203,036,598
1887	536,938,387	76.4	7,965,572	325,652,754	47.0	+219,251,205
1888	505,402,327	73.9	7,031,986	339,199,344	46.9	+173,234,969
1889	536,828,565	73.5	6,895,482	365,586,061	49.1	+178,137,986
1890	634,855,869	75.1	6,908,820	384,100,435	48.7	+257,664,254
1891	652,407,931	74.8	6,109,781	420,211,949	49.7	+238,305,763
1892	803,122,045	79.1	6,638,755	436,697,057	52.8	+373,063,743
1893	621,201,671	74.8	7,155,979	425,657,448	49.1	+202,700,202
1894	636,633,747	73.2	9,586,876	365,160,319	55.8	+281,060,304
1895	558,385,861	70.4	7,934,115	373,115,985	51.0	+193,203,991
1896	574,398,264	66.5	10,916,730	391,029,407	50.1	+194,285,587
1897	689,755,193	66.8	9,707,782	400,871,468	52.4	+298,591,507
1898	859,018,946	71.0	10,409,348	314,291,796	51.0	+555,136,498
1899	792,811,733	65.9	12,134,268	355,514,881	51.0	+449,431,120
1900	844,616,530	61.6	11,263,253	420,139,288	49.4	+435,740,495
1901	951,628,331	65.2	11,293,045	391,931,051	47.6	+570,990,325
1902	857,113,533	63.2	10,308,306	413,744,557	45.8	+453,677,282
1903	878,480,557	63.1	13,505,343	456,199,325	44.5	+435,786,575
1904	859,160,264	59.9	12,625,026	461,434,851	46.6	+410,350,439
1905	826,904,777	55.4	12,316,525	553,851,214	49.6	+285,370,088
1906	976,047,104	56.8	10,856,259	554,175,242	45.2	+432,728,121
1907	1,054,405,416	56.9	11,613,519	626,836,808	43.7	+439,182,127
1908	1,017,396,404	55.5	10,298,514	539,690,121	45.2	+488,004,797
1909	903,238,122	55.1	9,584,934	638,612,692	48.7	+274,210,304
1910	871,158,425	50.9	14,469,627	687,509,115	44.2	+198,118,937
1911	1,030,794,402	51.2	14,664,748	680,204,932	44.5	+365,254,218
Average:						
1851–1855	149,756,832	80.4	7,786,478	69,441,507	28.1	+ 88,101,803
1856–1860	229,371,677	82.4	9,601,144	118,860,567	37.0	+120,112,254
1861–1865	123,950,452	72.8	9,992,002	111,927,116	43.8	+ 22,015,338
1866–1870	240,440,127	78.1	7,896,364	168,194,161	41.2	+ 80,142,330
1871–1875	380,496,579	78.3	8,963,637	260,697,115	45.1	+128,763,101
1876–1880	525,902,563	79.2	8,083,926	253,725,726	51.5	+280,260,763
1881–1885	604,834,934	78.1	10,031,556	310,161,918	46.5	+304,704,572
1886–1890	543,067,777	74.8	7,307,210	344,109,985	48.0	+206,265,002
1891–1895	654,350,251	74.7	7,485,101	404,168,552	51.5	+257,666,800
1896–1900	752,120,133	66.2	10,886,276	376,369,368	50.8	+386,637,041
1901–1905	874,657,492	61.4	12,009,649	455,432,200	46.8	+431,234,941
1906–1910	964,449,094	55.1	11,364,571	609,364,796	45.3	+366,448,869

[1] Not including forest products.

Exports of selected domestic agricultural products, 1851–1911.

[Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are lacking, either there were no exports or they were not separately classified for publication. For "Beef, salted or pickled," and "Pork, salted or pickled," barrels, 1851–1865, were reduced to pounds at the rate of 200 pounds per barrel, and tierces, 1855–1865, at the rate of 300 pounds per tierce; cotton-seed oil, 1910, pounds reduced to gallons at the rate of 7.5 pounds per gallon. It is assumed that 1 barrel of corn meal is the product of 4 bushels of corn, and 1 barrel of wheat flour the product of 5 bushels of wheat prior to 1880 and of 4½ bushels of wheat in 1880 and subsequently.]

Year ending June 30—	Cattle.	Cheese.	Packing-house products.				
			Beef, cured—salted or pickled.	Beef, fresh.	Beef oils—oleo oil.	Beef (mostly)—tallow.	Beef and its products—total, as far as ascertainable in pounds.[1]
	Number.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1851	1,350	10,361,189	18,129,600			8,198,278	26,327,878
1852	1,078	6,650,420	24,451,800			4,767,020	29,218,820
1853	1,076	3,763,932	25,208,200			3,926,598	29,134,798
1854	1,022	7,003,974	25,244,000			9,325,471	34,569,471
1855	1,501	4,846,568	29,560,800			11,866,992	41,427,792
1856	2,478	8,737,029	25,437,800			7,458,471	32,896,271
1857	4,325	6,453,072	15,668,000			5,698,315	21,366,315
1858	28,247	8,098,527	23,961,400			8,283,812	32,245,212
1859	32,513	7,103,323	30,801,000			7,103,045	37,904,045
1860	27,501	15,515,799	38,858,800			15,269,535	54,128,335
1861	8,885	32,361,428	25,640,200			29,718,364	55,358,564
1862	3,634	34,052,678	27,204,400			46,773,768	73,978,168
1863	5,509	42,045,054	29,259,800			63,792,754	93,052,554
1864	6,191	47,751,329	35,666,400			55,197,914	90,864,314
1865	9,589	53,154,318	27,129,200			30,884,500	58,013,700
1866	7,730	36,411,985	19,053,800			19,364,686	38,418,486
1867	10,221	52,352,127	14,182,562			23,296,931	37,479,493
1868	16,120	51,097,203	22,683,531			22,682,412	45,365,943
1869		39,960,367	27,299,197			20,534,628	47,833,825
1870	27,530	57,296,327	26,727,773			37,513,056	64,240,829
1871	20,530	63,698,867	43,880,217			33,859,317	77,739,534
1872	28,033	66,204,025	26,652,094			76,151,218	102,803,312
1873	35,455	80,366,540	31,605,196			79,170,558	110,775,754
1874	56,067	90,611,077	36,036,537			101,755,631	137,792,168
1875	57,211	101,010,853	48,243,251			65,461,619	113,704,870
1876	51,593	97,676,264	36,596,150			72,432,775	109,028,925
1877	50,001	107,364,666	39,155,153	49,210,990		91,472,803	179,838,943
1878	80,040	123,783,736	38,831,379	54,046,771	1,698,401	85,505,919	180,082,470
1879	136,720	141,654,474	36,950,563	54,025,832	12,687,318	99,963,752	203,627,465
1880	182,756	127,553,907	45,237,472	84,717,194	19,844,256	110,767,627	260,566,549
1881	185,707	147,995,614	40,698,649	106,004,812	26,327,676	96,403,372	269,434,509
1882	108,110	127,989,782	45,899,737	69,586,466	19,714,338	50,474,210	187,832,197
1883	104,444	99,220,467	41,680,623	81,064,373	29,031,064	38,810,098	192,536,459
1884	190,518	112,869,575	42,379,911	120,784,064	37,785,159	63,091,103	266,219,082
1885	135,890	111,992,990	48,143,711	115,780,830	37,120,217	50,431,719	252,810,842
1886	119,065	91,877,235	58,903,370	99,423,362	27,729,885	40,919,951	228,729,576
1887	106,459	81,255,994	36,287,188	83,560,874	45,712,985	63,278,403	272,916,803
1888	140,208	88,008,458	48,980,269	93,498,273	30,146,595	92,483,052	307,379,042
1889	205,786	84,999,828	55,006,399	137,895,391	28,102,534	77,844,555	352,260,216
1890	394,836	95,376,053	97,508,419	173,237,596	68,218,098	112,745,370	536,986,026
1891	374,679	82,133,876	90,286,979	194,045,638	80,231,035	111,689,251	589,447,206
1892	394,607	82,100,221	70,204,736	220,554,617	91,581,703	89,780,010	561,713,699
1893	287,094	81,350,923	58,423,963	206,294,724	113,939,363	61,819,153	523,944,938
1894	359,278	73,852,134	62,682,667	193,891,824	123,295,895	54,661,524	495,624,104
1895	331,722	60,448,421	62,473,325	191,338,487	78,098,878	25,864,300	432,799,823
1896	372,461	36,777,291	70,709,209	224,783,225	103,276,756	52,759,212	521,804,584
1897	392,190	50,944,617	67,712,940	290,395,930	113,506,152	75,108,834	606,547,427
1898	439,255	53,167,280	44,314,479	274,768,074	132,579,277	81,744,809	576,433,797
1899	389,490	38,198,753	46,564,876	282,139,974	142,390,492	107,361,009	623,970,458
1900	397,286	48,419,353	47,306,513	329,078,609	146,739,681	89,030,943	674,284,723
1901	459,218	39,813,517	55,312,632	351,748,333	161,651,413	77,166,889	705,104,772
1902	392,884	27,203,184	48,632,727	301,824,473	138,546,088	34,065,758	596,254,520
1903	402,178	18,987,178	52,801,220	254,795,963	126,010,339	27,368,924	546,055,244
1904	593,409	23,335,172	57,584,710	299,579,671	165,183,839	76,924,174	663,147,095
1905	567,806	10,134,424	55,934,705	236,486,568	145,228,245	63,536,992	575,874,718

[1] Includes beef, canned; beef, cured—salted or pickled; beef, cured—other; beef, fresh; oils—oleo oil; oleomargarin; tallow.

Exports of selected domestic agricultural products, 1851–1911—Continued.

Year ending June 30—	Cattle.	Cheese.	Packing-house products. Beef, cured—salted or pickled.	Beef, fresh.	Beef oils—oleo oil.	Beef (mostly)—tallow.	Beef and its products—total, as far as ascertainable in pounds.
	Number.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1906	584,239	16,562,451	81,088,098	268,054,227	209,658,075	97,567,156	732,884,572
1907	423,051	17,285,230	62,645,281	281,651,502	195,337,176	127,857,739	689,752,420
1908	349,210	8,439,031	46,958,367	201,154,105	212,541,157	91,397,507	579,303,478
1909	207,542	6,822,842	44,494,210	122,952,671	179,985,246	53,332,767	418,844,332
1910	139,430	2,846,709	36,554,266	75,729,666	126,091,675	29,379,992	286,295,874
1911	150,100	10,366,605	40,283,749	42,510,731	138,696,906	29,813,154	265,923,983
Average:							
1851–1855	1,205	6,525,217	24,518,880	....	....	7,616,872	32,135,752
1856–1860	19,013	9,181,550	26,945,400	....	....	8,762,636	35,708,036
1861–1865	6,762	41,872,961	28,980,000	....	....	45,273,460	74,253,460
1866–1870	....	47,423,602	21,989,373	....	....	24,678,343	46,667,715
1871–1875	39,459	80,378,272	37,283,459	....	....	71,279,669	108,563,128
1876–1880	100,222	119,606,609	39,354,143	....	....	92,028,575	186,628,870
1881–1885	144,934	120,013,686	43,760,526	98,644,109	29,995,691	59,842,100	233,766,618
1886–1890	193,271	88,303,514	59,337,129	117,523,099	39,982,019	77,454,266	339,654,333
1891–1895	349,476	75,977,115	68,814,334	201,225,058	97,429,375	68,762,848	520,705,954
1896–1900	398,136	45,501,459	55,321,603	280,233,162	127,698,472	81,200,961	600,608,198
1901–1905	483,099	23,894,695	54,053,199	288,887,002	147,323,985	55,812,547	617,287,270
1906–1910	340,694	10,391,253	54,348,044	189,908,434	184,722,666	79,907,032	541,416,135

Year ending June 30—	Packing-house products—Continued. Pork, cured—bacon.	Pork, cured—hams.[1]	Pork, cured—salted or pickled.	Pork—lard.	Pork and its products—total, as far as ascertainable in pounds.[2]	Apples, fresh.	Corn and corn meal (converted to corn).
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Barrels.*	*Bushels.*
1851	18,027,302	....	33,041,200	19,683,082	70,751,584	28,842	4,241,299
1852	5,746,816	....	16,676,400	21,281,951	43,705,167	18,411	3,351,495
1853	18,390,027	....	25,976,200	24,435,014	68,801,241	45,075	3,123,381
1854	45,953,473	....	44,029,400	44,450,154	134,433,027	15,326	8,798,428
1855	38,188,989	....	59,752,000	39,025,492	136,966,481	33,959	8,876,417
1856	41,748,092	....	56,279,000	37,582,271	135,609,363	74,287	11,466,708
1857	43,863,539	....	28,902,600	40,246,544	113,012,683	33,201	8,575,334
1858	20,954,374	....	31,975,000	33,022,286	85,951,660	27,711	5,716,693
1859	11,989,694	....	41,148,400	28,362,706	81,500,800	32,979	2,755,538
1860	25,844,610	....	40,948,600	40,289,519	107,082,729	78,809	4,248,991
1861	50,264,267	....	31,297,400	47,908,911	129,470,578	112,523	11,491,496
1862	141,212,786	....	61,820,400	118,573,307	321,606,493	66,767	19,919,178
1863	218,243,609	....	65,570,400	155,336,596	439,150,605	174,502	17,151,268
1864	110,886,446	....	63,519,400	97,190,765	271,596,611	183,969	5,146,122
1865	46,053,034	....	41,786,800	44,480,136	132,319,970	120,317	3,616,653
1866	37,588,930	....	30,056,788	30,110,451	97,756,169	51,612	14,465,751
1867	25,648,226	....	27,374,877	45,608,031	98,631,134	29,577	16,026,947
1868	43,659,064	....	28,690,133	64,555,462	136,904,659	19,874	12,493,522
1869	49,228,165	....	24,439,832	41,887,545	115,555,542	....	8,286,665
1870	38,968,256	....	24,639,831	35,808,530	99,416,617	38,157	2,140,487
1871	71,446,854	....	39,250,750	80,037,297	190,734,901	49,088	10,673,553
1872	246,208,143	....	57,169,518	199,651,660	503,029,321	36,508	35,727,010
1873	395,381,737	....	64,147,461	230,534,207	690,063,405	241,663	40,154,374
1874	347,405,405	....	70,482,379	205,527,471	623,415,255	44,928	35,985,834
1875	250,286,549	....	56,152,331	166,869,393	473,308,273	276,209	30,025,036
1876	327,730,172	....	54,195,118	168,405,839	550,331,129	64,472	50,910,532
1877	460,057,146	....	69,671,894	234,741,233	764,470,273	417,065	72,652,611
1878	592,814,351	....	71,889,255	342,766,254	1,007,469,860	101,617	87,192,110
1879	732,249,576	....	84,401,676	326,658,686	1,143,309,938	505,018	87,884,892
1880	759,773,109	....	95,949,780	374,979,286	1,230,702,175	407,911	99,572,392
1881	673,274,361	73,670,184	107,928,086	378,142,496	1,233,015,127	1,117,065	93,648,147
1882	428,481,482	39,545,158	80,447,466	250,367,740	798,841,846	176,704	44,340,683
1883	294,118,759	46,139,911	62,116,302	224,718,474	627,093,446	313,921	41,655,653
1884	341,579,410	47,919,958	60,363,313	265,094,719	715,142,817	105,400	46,258,606
1885	345,924,217	54,202,902	71,649,365	283,216,339	755,416,926	668,867	52,876,456

[1] Subsequent to 1904, including shoulders.
[2] Includes lard; pork, canned; pork, cured—bacon; pork, cured—hams; pork, cured—salted or pickled; pork, fresh.

Exports of selected domestic agricultural products, 1851-1911—Continued.

Year ending June 30—	Packing-house products—Continued.					Apples, fresh.	Corn and corn meal (converted to corn).
	Pork, cured—bacon.	Pork, cured—hams.	Pork, cured—salted or pickled.	Pork—lard.	Pork and its products—total, as far as ascertainable, in pounds.		
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Barrels.*	*Bushels.*
1886	369,423,351	50,365,445	87,196,966	293,728,019	800,784,530	744,539	64,829,617
1887	364,417,744	55,505,211	85,869,367	321,533,746	827,349,998	591,868	41,368,584
1888	331,306,703	44,132,980	58,836,966	297,740,007	732,079,843	489,570	25,360,869
1889	357,377,399	42,847,247	64,110,845	318,242,990	782,601,275	942,406	70,841,673
1890	531,899,677	76,591,279	79,788,868	471,083,598	1,159,642,885	453,506	103,418,709
1891	514,675,557	84,410,108	81,317,364	498,343,927	1,179,565,831	135,207	32,041,529
1892	507,919,830	76,856,559	80,336,481	460,045,776	1,125,536,392	938,743	76,602,285
1893	391,758,175	82,178,154	52,459,722	365,693,501	893,002,196	408,014	47,121,894
1894	416,657,577	86,970,571	63,575,881	447,566,867	1,015,939,543	78,580	66,489,529
1895	452,549,976	105,494,123	58,266,893	474,895,274	1,092,024,847	818,711	28,585,405
1896	425,352,187	129,036,351	69,498,373	509,534,256	1,134,165,823	360,002	101,100,375
1897	500,399,448	165,247,302	66,768,920	568,315,640	1,302,037,734	1,503,981	178,817,417
1898	650,108,933	200,185,861	88,133,078	709,344,045	1,659,996,202	605,390	212,055,543
1899	562,651,480	225,846,750	137,197,200	711,259,851	1,678,265,645	380,222	177,255,046
1900	512,153,729	196,414,412	133,199,683	661,813,663	1,538,024,466	526,636	213,123,412
1901	456,122,741	216,571,803	138,643,611	611,357,514	1,462,369,849	883,673	181,405,473
1902	383,150,624	227,653,232	115,896,275	556,840,222	1,337,315,909	459,719	28,028,688
1903	207,336,000	214,183,365	95,287,374	490,755,821	1,042,119,570	1,656,129	76,639,261
1904	249,665,941	194,948,864	112,224,861	561,302,643	1,146,255,441	2,018,262	58,222,061
1905	262,246,635	203,458,724	118,887,189	610,238,899	1,220,031,970	1,499,942	90,293,483
1906	361,210,563	194,267,949	141,820,720	741,516,886	1,464,960,356	1,208,989	119,893,833
1907	250,418,699	209,481,496	166,427,409	627,559,660	1,268,065,412	1,539,267	86,368,228
1908	241,189,929	221,769,634	149,505,937	603,413,770	1,237,210,760	1,049,545	55,063,860
1909	244,578,674	212,170,224	52,354,980	528,722,933	1,053,142,056	896,279	37,665,040
1910	152,163,107	146,885,385	40,031,599	362,927,671	707,110,062	922,078	38,128,498
1911	156,675,310	157,709,316	45,729,471	476,107,857	879,455,006	1,721,106	65,614,522
Average:							
1851-1855	25,261,321	....	35,895,040	29,775,139	90,931,500	28,323	5,678,204
1856-1860	28,880,062	....	39,850,720	35,900,665	104,631,447	49,397	6,552,653
1861-1865	113,332,028	....	52,798,880	92,697,943	258,828,851	131,616	11,464,943
1866-1870	39,018,528	....	27,040,292	43,594,004	109,652,824	....	10,682,674
1871-1875	262,145,738	....	57,440,488	176,524,006	496,110,231	129,679	30,513,161
1876-1880	574,524,871	....	75,221,545	289,510,260	939,256,675	299,217	79,642,495
1881-1885	416,675,646	52,295,623	76,500,906	280,307,954	825,902,032	476,391	55,755,909
1886-1890	390,884,975	53,888,432	75,160,602	340,465,672	860,491,706	644,378	61,163,890
1891-1895	456,712,223	87,181,903	67,191,268	449,309,069	1,061,213,762	475,851	50,168,128
1896-1900	530,133,155	183,346,135	98,959,451	632,053,491	1,462,497,974	675,246	176,470,359
1901-1905	311,704,388	211,363,198	116,187,862	566,099,020	1,241,618,548	1,303,545	86,917,793
1906-1910	249,912,194	196,914,938	110,028,129	572,828,184	1,146,097,729	1,123,232	67,423,892

Year ending June 30—	Hops.	Oils, vegetable—cottonseed oil.	Rice and rice bran, meal, and polish.	Sugar, raw and refined.	Wheat.	Wheat flour.	Wheat and wheat flour (converted to wheat).
	Pounds.	*Gallons.*	*Pounds.*	*Pounds.*	*Bushels.*	*Barrels.*	*Bushels.*
1851	110,360	....	63,354,000	3,251,369	1,026,725	2,202,335	12,038,400
1852	238,008	....	71,839,800	2,498,390	2,694,540	2,799,339	16,691,235
1853	245,647	....	40,624,200	5,827,331	3,890,141	2,920,918	18,494,731
1854	260,026	....	63,072,600	9,893,751	8,036,665	4,022,386	28,148,595
1855	4,021,816	....	39,421,600	11,160,945	798,884	1,204,540	6,821,584
1856	1,048,515	....	67,616,000	9,271,191	8,154,877	3,510,626	25,708,007
1857	924,538	....	68,322,800	5,338,247	14,570,331	3,712,053	33,130,596
1858	458,889	....	58,122,200	7,201,120	8,926,196	3,512,169	26,487,041
1859	587,953	....	77,070,400	6,558,757	3,002,016	2,431,824	15,161,136
1860	273,257	....	81,632,600	4,466,031	4,155,153	2,611,596	17,213,133
1861	8,835,837	....	43,512,400	6,511,134	31,238,057	4,323,756	52,856,837
1862	4,860,046	....	4,221,600	2,755,252	37,289,572	4,882,033	61,699,737
1863	8,864,081	....	1,694,800	3,595,009	36,160,414	4,390,055	58,110,689
1864	5,851,165	....	2,176,800	2,328,483	23,681,712	3,557,347	41,468,447
1865	3,671,371	....	983,200	1,900,002	9,937,876	2,641,298	23,144,366

Exports of selected domestic agricultural products, 1851–1911—Continued.

Year ending June 30—	Hops.	Oils, vegetable—cottonseed oil.	Rice and rice bran, meal, and polish.	Sugar, raw and refined.	Wheat.	Wheat flour.	Wheat and wheat flour (converted to wheat).
	Pounds.	*Gallons.*	*Pounds.*	*Pounds.*	*Bushels.*	*Barrels.*	*Bushels.*
1866	349,987	....	2,212,901	4,460,138	5,579,103	2,183,050	16,494,353
1867	1,001,603	....	1,394,007	8,130,175	6,146,411	1,300,106	12,646,941
1868	532,038	....	3,079,043	2,218,150	15,940,899	2,076,423	26,323,014
1869	11,269,555	....	2,232,833	3,167,523	17,557,836	2,431,873	29,717,201
1870	16,356,231	....	2,133,014	4,427,576	36,584,115	3,463,333	53,900,780
1871	3,273,653	....	445,842	3,841,078	34,304,906	3,653,841	52,574,111
1872	3,061,244	547,165	403,835	4,478,492	26,423,080	2,514,535	38,995,755
1873	1,795,437	709,576	276,637	10,083,363	39,204,285	2,562,086	52,014,715
1874	117,358	782,067	558,922	10,132,911	71,039,928	4,094,094	91,510,398
1875	3,066,703	417,387	277,337	24,152,388	53,047,177	3,973,128	72,912,817
1876	9,191,589	281,054	439,991	51,863,691	55,073,122	3,935,512	74,750,682
1877	9,581,108	1,705,422	1,306,982	39,751,324	40,325,611	3,343,665	57,043,936
1878	18,458,782	4,992,349	631,105	44,093,092	72,404,961	3,947,333	92,141,626
1879	5,458,159	5,352,530	740,136	72,352,964	122,353,936	5,629,714	150,502,506
1880	9,739,566	6,997,796	183,534	30,142,004	153,252,795	6,011,419	180,304,181
1881	8,990,655	3,444,084	150,451	22,252,833	150,565,477	7,945,786	186,321,514
1882	5,867,363	713,549	143,289	13,814,005	95,271,802	5,915,686	121,892,389
1883	7,817,228	415,611	136,143	28,542,115	106,385,828	9,205,664	147,811,316
1884	13,516,643	3,605,946	163,519	76,122,813	70,349,012	9,152,260	111,534,182
1885	7,055,289	6,364,279	663,502	252,740,427	84,653,714	10,648,145	132,570,366
1886	13,665,661	6,240,139	1,700,576	164,429,490	57,759,209	8,179,241	94,565,793
1887	260,721	4,067,138	4,126,630	190,804,677	101,971,949	11,518,449	153,804,969
1888	6,793,818	4,458,597	1,858,735	34,646,157	65,789,261	11,963,574	119,625,344
1889	12,589,262	2,690,700	2,890,027	14,259,414	46,414,129	9,374,803	88,600,743
1890	7,540,854	13,384,385	3,681,979	27,225,469	54,387,767	12,231,711	109,430,467
1891	8,736,080	11,003,160	3,490,895	108,433,474	55,131,948	11,344,304	106,181,316
1892	12,604,686	13,859,278	10,256,796	14,850,391	157,280,351	15,196,769	225,665,811
1893	11,367,030	9,462,074	13,711,798	20,746,327	117,121,109	16,620,339	191,912,635
1894	17,472,975	14,958,309	10,766,249	15,468,496	88,415,230	16,859,533	164,283,129
1895	17,523,388	21,187,728	1,623,336	9,529,008	76,102,704	15,268,892	144,812,718
1896	16,765,254	19,445,848	15,031,554	9,402,524	60,650,080	14,620,864	126,443,968
1897	11,426,241	27,198,882	3,905,754	8,305,219	79,562,020	14,569,545	145,124,972
1898	17,161,669	40,230,784	6,200,987	6,508,290	148,231,261	15,349,943	217,306,005
1899	21,145,512	50,627,219	15,334,689	9,865,347	139,432,815	18,485,690	222,618,420
1900	12,639,474	46,902,390	41,066,417	22,514,603	101,950,389	18,699,194	186,096,762
1901	14,963,676	49,356,741	25,527,846	8,874,860	132,060,667	18,650,979	215,990,073
1902	10,715,151	33,042,848	29,591,274	7,572,452	154,856,102	17,759,203	234,772,516
1903	7,794,705	35,642,994	19,750,448	10,520,156	114,181,420	19,716,484	202,905,598
1904	10,985,988	29,013,743	29,121,763	15,418,537	44,230,169	16,999,432	120,727,613
1905	14,858,612	51,535,580	113,282,760	18,348,077	4,394,402	8,826,335	44,112,910
1906	13,026,904	43,793,519	38,142,103	22,175,846	34,973,291	13,919,048	97,609,007
1907	16,809,534	41,880,304	30,174,371	21,237,603	76,569,423	15,584,667	146,700,425
1908	22,920,480	41,019,991	28,444,415	25,510,643	100,371,057	13,927,247	163,043,669
1909	10,446,884	51,087,329	20,511,429	79,946,297	66,923,244	10,521,161	114,268,468
1910	10,589,254	29,860,667	26,779,188	125,507,022	46,679,876	9,040,987	87,364,318
1911	13,104,774	30,069,459	30,063,341	54,947,444	23,729,302	10,129,435	69,311,760
Average:							
1851–1855	975,171	....	55,662,440	6,526,357	3,289,391	2,629,904	16,438,909
1856–1860	658,630	....	70,552,800	6,567,069	7,761,715	3,155,654	23,539,985
1861–1865	6,416,500	....	10,517,760	3,417,976	27,661,526	3,958,898	47,456,016
1866–1870	5,901,883	....	2,210,360	4,480,712	16,361,673	2,290,957	27,816,458
1871–1875	2,262,879	....	392,515	10,537,646	44,803,875	3,359,537	61,601,560
1876–1880	10,485,841	3,865,830	660,350	47,640,615	88,682,085	4,573,529	110,948,586
1881–1885	8,649,436	2,908,694	251,381	78,694,439	101,445,167	8,573,508	140,025,953
1886–1890	8,170,063	6,168,192	2,851,589	86,273,041	65,264,463	10,653,556	113,205,463
1891–1895	13,540,832	14,094,110	7,969,815	33,805,539	98,810,268	15,057,967	166,571,122
1896–1900	15,827,630	36,881,025	16,307,880	11,319,197	105,965,313	16,345,047	179,518,025
1901–1905	11,863,626	39,718,381	43,454,818	12,146,816	89,944,552	16,390,487	163,701,742
1906–1910	14,758,611	41,528,362	28,810,301	54,875,482	65,103,378	12,598,622	121,797,177

Imports of selected agricultural products, 1851–1911.

[Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are lacking, either there were no imports or they were not separately classified for publication. "Silk" includes, prior to 1881, only "Silk, raw or as reeled from the cocoon;" in 1881 and 1882 are included this item and "Silk waste;" after 1882, both these items and "Silk cocoons." From "Cocoa and chocolate" are omitted in 1860, 1861 and in 1872 to 1881, small quantities of chocolate, the official returns for which were given only in value. "Jute and jute butts" includes in 1858 and 1859 an unknown quantity of "Sisal grass, coir, etc.," and in 1865–1868 an unknown quantity of "Hemp." Cattle hides are included in "Hides and skins other than cattle and goat" in 1895–1897. Olive oil for table use includes in 1862–1864 and 1885–1905 all olive oil. Sisal grass includes in 1884–1890 "Other vegetables ubstances." Hemp includes in 1885–1888 all substitutes for hemp.]

Year ending June 30—	Cheese.	Silk.	Wool.	Almonds.	Argols or wine lees.	Cocoa and chocolate, total.	Coffee.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1851	603,398		32,607,315	2,854,804		2,198,609	152,519,743
1852	514,337		18,343,218	1,564,703		1,372,341	193,906,353
1853	874,949		21,616,035	4,721,250		3,453,268	199,408,045
1854	969,417		20,282,635	2,187,934		3,162,072	162,255,993
1855	1,526,942		18,814,402	3,716,251		2,427,707	191,478,657
1856	1,384,272		16,280,947	5,113,897		2,017,471	235,865,268
1857	1,400,252		17,750,156	2,845,594		2,044,637	240,676,227
1858	1,589,066			2,210,941		1,810,449	189,211,300
1859	1,409,420			5,439,210		5,067,369	264,436,534
1860	1,401,161			2,873,014		3,186,721	202,144,733
1861	1,090,835			2,886,698	976,072	3,210,291	184,706,655
1862	594,822			918,360	866,404	3,541,364	122,799,311
1863	545,966			1,726,281	1,007,585	2,055,198	80,461,614
1864	836,127	407,935		3,964,875	1,597,790	2,940,571	131,622,782
1865	985,362			1,229,112	1,297,962	1,177,594	106,463,062
1866		567,904		4,571,687	2,004,996	2,550,978	181,413,192
1867	1,738,657	491,983		4,315,819	1,876,731	3,387,890	187,236,580
1868	2,997,944	512,449		1,461,007	1,822,498	3,211,976	248,983,900
1869		720,045	39,275,926		2,346,978	3,826,905	254,160,993
1870		583,589			2,591,472	3,640,845	235,256,574
1871		1,100,281			3,164,965	3,445,453	317,992,048
1872		1,063,809			4,942,601	4,917,809	298,805,946
1873		1,159,420	85,496,049		4,007,779	5,734,356	293,297,271
1874		794,837	42,939,541		3,246,376	3,661,992	285,171,512
1875		1,101,681	54,901,760		5,512,808	5,257,255	317,970,665
1876		1,354,991	44,642,836		7,047,802	4,715,406	339,789,246
1877		1,186,170	42,171,192		9,025,542	4,694,215	331,639,723
1878		1,182,750	48,449,079		10,257,909	4,780,339	309,882,540
1879		1,889,776	39,005,155		14,011,764	5,827,027	377,848,473
1880		2,562,236	128,131,747		14,445,534	7,508,130	446,850,727
1881		2,790,413	55,964,236		14,275,530	8,767,728	455,189,534
1882		3,221,269	67,861,744		18,320,366	11,091,123	459,922,768
1883		4,731,106	70,575,478		16,112,427	9,437,791	515,878,515
1884	6,243,014	4,284,888	78,350,651	3,828,104	19,591,039	12,739,871	534,785,542
1885	6,247,560	4,308,908	70,596,170	4,732,269	17,694,336	10,868,497	572,599,552
1886	6,309,124	6,818,060	129,084,958	5,822,733	16,041,666	13,703,583	564,707,533
1887	6,592,192	6,028,091	114,038,030	5,482,363	22,024,768	13,005,327	526,109,170
1888	8,750,185	6,370,322	113,558,753	5,747,957	17,226,491	17,502,929	423,645,794
1889	8,207,026	6,645,124	126,487,729	5,545,400	21,429,434	17,929,076	578,397,454
1890	9,263,573	7,510,440	105,431,285	5,715,858	24,908,054	19,894,130	499,159,120
1891	8,863,640	6,266,629	129,303,648	6,812,061	21,579,102	23,278,785	519,528,432
1892	8,305,288	8,834,049	148,670,652	7,629,392	24,813,171	23,712,261	640,210,788
1893	10,195,924	8,497,477	172,433,838	6,679,147	28,770,810	26,459,880	563,469,068
1894	8,742,851	5,902,485	55,152,585	7,436,784	22,373,180	19,899,393	550,934,337
1895	10,276,293	9,316,460	206,033,906	7,903,375	27,911,122	31,638,261	652,208,975
1896	10,728,397	9,363,987	230,911,473	7,789,681	28,481,665	25,666,373	580,597,915
1897	12,319,122	7,993,444	350,852,026	9,644,338	23,457,576	34,370,048	737,645,670
1898	10,012,188	12,087,951	132,795,202	5,746,362	19,202,629	27,525,513	870,514,455
1899	11,826,175	11,250,383	76,736,209	9,957,427	23,300,762	37,563,098	831,827,063
1900	13,455,990	13,073,718	155,928,455	6,317,633	27,339,489	43,968,252	787,991,911
1901	15,329,099	10,405,555	103,583,505	5,140,232	28,598,781	47,620,204	854,871,310
1902	17,067,714	14,234,826	166,576,966	9,868,982	29,276,148	52,878,587	1,091,004,252
1903	20,671,384	15,270,859	177,137,796	8,142,164	29,966,557	65,046,884	915,086,380
1904	22,707,103	16,722,709	173,742,834	9,838,852	24,571,730	75,070,746	995,043,284
1905	23,095,705	22,357,307	249,135,746	11,745,081	26,281,931	77,383,024	1,047,792,984

Imports of selected agricultural products, 1851–1911—Continued.

Year ending June 30—	Cheese.	Silk.	Wool.	Almonds.	Argols or wine lees.	Cocoa and chocolate, total.	Coffee.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1906	27,286,866	17,352,021	201,688,668	15,009,326	28,140,835	84,127,027	851,668,933
1907	33,848,766	18,743,904	203,847,545	14,233,613	30,540,893	97,059,513	985,321,473
1908	32,530,830	16,662,132	125,980,524	17,144,968	26,738,834	86,604,684	890,640,057
1909	35,548,143	25,187,957	266,409,304	11,029,421	32,115,646	132,660,931	1,049.868,768
1910	40,817,524	23,457,223	263,928,232	18,556,356	28,182,956	111,070,834	871,469,516
1911	45.568,797	26,666,091	137,647,641	15,522,712	29,175,133	140,970,877	875,366,797
Average:							
1851–1855	897,809	....	22,332,721	3,008,988	....	2,522,799	179,913,758
1856–1860	1,436,834	....	....	3,696,531	....	2,825,329	226,466,812
1861–1865	810,622	....	....	2,145,065	1,149,163	2,585,004	125,210,685
1866–1870	....	575,194	....	....	2,128,535	3,323,719	221,410,248
1871–1875	....	1,044,006	....	....	4,174,906	4,603,373	302,647,488
1876–1880	....	1,635,185	60,480,002	....	10,957,710	5,505,023	361,202,142
1881–1885	....	3,867,317	68,669,656	....	17,198,740	10,581,002	507,675,182
1886–1890	7,824,420	6,674,407	117,720,151	5,662,862	20,326,083	16,407,009	518,403,814
1891–1895	9,276,799	7,763,420	142,318,926	7,292,152	25,089,477	24,997,716	585,270,320
1896–1900	11,668,374	10,753,897	189.444,673	7,891,088	24,356,424	33,818,657	761,715,403
1901–1905	19,774,201	15,798,251	174,035,369	8,947,062	27,739,029	63,599,889	980,759,642
1906–1910	34,006,426	20,280,647	212,370,855	15,194,737	29,143,833	102,304,598	929,793,749

Year ending June 30—	Flax.	Hemp.	Hops.	Jute and jute butts.	Licorice root.	Manila.	Molasses.
	Tons.	*Tons.*	*Pounds.*	*Tons.*	*Pounds.*	*Tons.*	*Gallons.*
1851	1,059	1,876	....	1,919	....	9,917	36,376,772
1852	1,411	1,341	....	2,012	....	8,469	32,795,610
1853	678	2,621	....	1,269	....	12,510	31,886,100
1854	1,160	2,632	....	4,368	....	10,510	27,759,463
1855	1,454	961	....	4,665	607,596	14,254	26,385,593
1856	1,011	317	....	3,908	401,277	14,678	23,617,674
1857	1,149	3,082	....	5,589	1,099,073	17,668	32,705,844
1858	....	2,314	....	21,586	668,786	....	24,566,357
1859	....	3,378	....	22,538	993,161	....	32,818,146
1860	....	2,274	....	23,279	2,561,964	....	30,922,633
1861	....	2,211	....	13,203	1,539,882	6,366	29,941,397
1862	693	2,218	....	2,004	460,632	10,329	25,157,280
1863	1,594	732	....	2,592	1,173,034	13,961	30,854,264
1864	1,650	1,195	....	2,498	4,715,628	16,735	33,571,230
1865	....	1,627	3,837	2,990	793,197	13,948	36,445,906
1866	....	....	1,696,681	5,980	2,296,970	22,856	45,285,983
1867	1,571	3,193	865,016	7,809	3,034,255	15,273	56,123,079
1868	....	....	3,585,843	3,690	2,183,376	17,390	56,408,435
1869	1,953	18,731	....	17,549	....	....	53,304,030
1870	1,927	22,557	....	19,049	....	....	56,373,537
1871	3,672	20,805	....	26,450	....	....	44,401,359
1872	5,274	27,613	....	41,851	....	....	45,214,403
1873	4,171	20,573	....	63,329	....	....	43,533,909
1874	3,426	24,325	....	36,991	....	....	47,189,837
1875	4,322	23,063	....	43,402	....	....	49,112,255
1876	3,659	17,979	....	60,368	....	....	39,026,200
1877	4,498	17,128	....	50,793	....	....	30,327,825
1878	4,045	20,503	....	40,997	....	....	27,577,542
1879	2,935	17,711	....	69,590	....	....	38,460,347
1880	4,378	24,902	....	82,471	....	....	38,120,880
1881	5,446	32,044	497,243	68,631	....	....	28,708,221
1882	5,563	36,679	955,854	84,186	....	....	37,268,830
1883	5,748	29,063	2,122,589	125,318	....	....	33,228,276
1884	5,086	25,925	701,104	64,389	39,056,653	....	34,128,640
1885	6,435	32,463	1,642,086	98,343	26,406,008	....	31,392,893
1886	5,557	28,655	2,672,762	83,054	58,531,952	....	39,079,808
1887	7,140	32,739	18,538,049	88,514	79,603,835	....	38,007,700
1888	5,691	47,947	5,585,033	115,163	49,167,173	....	35,582,539
1889	7,896	55,835	4,176,158	88,655	57,068,600	....	27,024,551
1890	8,048	36,591	6,539,516	90,399	55,229,348	....	31,497,243

Imports of selected agricultural products, 1851–1911—Continued.

Year ending June 30—	Flax.	Hemp.	Hops.	Jute and jute butts.	Licorice root.	Manila.	Molasses.
	Tons.	*Tons.*	*Pounds.*	*Tons.*	*Pounds.*	*Tons.*	*Gallons.*
1891	6,331	11,484	4,019,603	141,704	55,307,911	35,331	20,604,463
1892	7,812	5,187	2,506,224	88,624	98,659,583	44,574	22,448,209
1893	6,696	4,817	2,691,244	82,231	93,002,250	59,439	15,490,679
1894	4,352	1,635	828,022	50,037	70,158,301	35,233	19,670,663
1895	7,233	6,954	3,133,664	110,671	83,281,275	50,278	15,075,879
1896	7,833	8,450	2,772,045	88,992	87,123,461	47,244	4,687,664
1897	9,190	5,120	3,017,821	68,550	62,370,337	46,260	3,702,471
1898	5,529	4,017	2,375,922	112,306	70,136,591	50,270	3,603,547
1899	6,474	3,941	1,319,319	83,161	98,432,319	53,195	5,821,556
1900	6,967	3,400	2,589,725	102,693	106,333,199	42,624	7,025,068
1901	6,878	4,057	2,606,708	103,140	100,105,654	43,735	11,453,156
1902	7,772	6,054	2,805,293	128,963	109,077,323	56,453	14,391,215
1903	8,155	4,919	6,012,510	79,703	88,580,611	61,648	17,240,399
1904	10,123	5,871	2,758,163	96,735	89,463,182	65,666	18,828,530
1905	8,089	3,987	4,339,379	98,215	108,443,892	61,562	19,477,885
1906	8,729	5,317	10,113,989	103,945	102,151,969	58,738	16,021,076
1907	8,656	8,718	6,211,893	104,489	66,115,863	54,513	24,630,935
1908	9,528	6,213	8,493,265	107,533	109,355,720	52,467	18,882,756
1909	9,870	5,208	7,386,574	156,685	97,742,776	61,902	22,092,696
1910	12,761	6,423	3,200,560	68,155	82,207,496	93,253	31,292,165
1911	7,792	5,278	8,557,531	65,238	125,135,490	74,308	23,838,190
Average:							
1851–1855	1,151	1,886	...	2,847	...	11,132	31,040,708
1856–1860	...	2,273	...	15,380	1,144,852	...	28,926,131
1861–1865	...	1,597	...	4,657	1,736,475	12,268	31,194,015
1866–1870	...	...	...	10,815	...	...	53,499,013
1871–1875	4,173	23,276	...	42,405	...	...	45,890,353
1876–1880	3,903	19,645	...	60,844	...	...	34,702,559
1881–1885	5,656	31,235	1,183,775	88,173	...	...	32,945,372
1886–1890	6,866	40,353	7,502,304	93,157	59,920,182	...	34,238,368
1891–1895	6,485	6,015	2,635,751	94,653	80,081,864	44,971	18,657,979
1896–1900	7,199	4,986	2,414,966	91,140	84,879,181	47,919	4,968,061
1901–1905	8,203	4,978	3,704,411	101,351	99,134,132	57,813	16,278,237
1906–1910	9,909	6,376	7,081,256	108,161	91,514,765	64,175	22,583,926

Year ending June 30—	Olive oil, for table use.	Opium, crude.	Potatoes.	Rice, and rice flour, rice meal, and broken rice.	Sisal grass.	Sugar, raw and refined.	Tea.
	Gallons.	*Pounds.*	*Bushels.*	*Pounds.*	*Tons.*	*Pounds.*	*Pounds.*
1851	...	40,885	299,132	...	...	380,402,289	17,461,114
1852	...	42,123	322,223	...	...	457,511,093	29,437,206
1853	...	131,370	353,082	...	...	464,392,286	22,721,745
1854	...	108,178	306,187	...	...	455,928,585	24,417,712
1855	...	111,229	516,241	...	...	473,809,847	25,333,097
1856	...	157,814	535,320	...	...	545,226,430	22,889,850
1857	...	131,154	693,611	...	...	776,984,262	20,367,824
1858	...	135,915	...	...	...	519,200,387	32,995,021
1859	...	71,839	...	...	...	655,846,362	29,268,757
1860	...	119,525	...	...	...	694,838,197	31,696,657
1861	...	109,536	753,511	...	...	809,749,958	26,419,956
1862	292,024	194,844	837,223	56,861,317	287	557,139,529	24,795,983
1863	173,561	62,618	327,315	61,196,740	567	522,122,085	29,761,037
1864	79,457	93,114	4,497	99,691,447	1,021	632,230,247	37,229,176
1865	87,860	110,790	10,955	60,407,756	332	651,638,818	19,568,318
1866	256,833	181,585	78,194	76,209,397	870	1,000,055,024	42,992,738
1867	124,497	135,305	198,265	44,782,223	864	849,054,006	39,892,658
1868	161,313	183,263	209,555	59,140,707	1,661	1,121,189,415	37,843,612
1869	176,687	157,182	138,470	53,065,191	...	1,247,833,430	43,754,354
1870	159,397	254,609	75,336	43,123,939	...	1,196,773,569	47,408,481
1871	142,243	315,121	458,758	64,655,827	...	1,277,473,653	51,364,919
1872	196,364	416,864	96,259	74,642,631	...	1,509,185,674	63,811,003
1873	182,818	319,134	346,840	83,755,225	...	1,568,304,592	64,815,136
1874	139,241	395,909	549,073	73,257,716	...	1,701,297,869	55,811,605
1875	176,119	305,136	188,757	59,414,749	...	1,797,509,990	64,856,899

Imports of selected agricultural products, 1851–1911—Continued.

Year ending June 30—	Olive oil, for table use.	Opium, crude.	Potatoes.	Rice, and rice flour, rice meal, and broken rice.	Sisal grass.	Sugar, raw and refined.	Tea.
	Gallons.	*Pounds.*	*Bushels.*	*Pounds.*	*Tons.*	*Pounds.*	*Pounds.*
1876	178,232	388,311	92,148	71,561,852	....	1,493,977,472	62,887,153
1877	194,069	349,223	3,205,555	64,013,064	....	1,654,556,831	58,347,112
1878	217,017	430,950	528,584	47,489,878	....	1,537,451,934	65,366,704
1879	192,326	405,957	2,624,149	75,824,923	....	1,834,365,836	60,194,673
1880	264,762	533,451	721,868	57,006,255	....	1,829,301,684	72,162,936
1881	224,362	318,700	2,170,372	68,739,409	....	1,946,865,165	81,843,988
1882	264,838	370,249	8,789,860	79,412,841	....	1,990,449,609	78,769,060
1883	257,375	457,499	2,362,362	96,673,080	....	2,137,819,123	73,479,164
1884	....	326,539	425,408	106,630,523	32,082	2,756,416,896	67,665,910
1885	493,928	334,169	658,633	119,074,577	36,897	2,717,884,653	72,104,956
1886	634,354	471,276	1,937,416	97,562,353	35,300	2,689,881,765	81,887,998
1887	744,766	568,263	1,432,490	103,950,359	36,355	3,136,443,240	89,831,221
1888	654,162	477,020	8,259,538	155,623,501	36,401	2,700,284,282	84,627,870
1889	893,338	391,563	883,380	186,376,560	38,542	2,762,202,967	79,575,984
1890	893,984	473,095	3,415,578	124,029,171	50,858	2,934,011,560	83,886,829
1891	605,509	466,554	5,401,912	214,363,582	39,213	3,483,477,222	83,453,339
1892	706,486	587,118	186,871	148,103,688	48,020	3,556,509,165	90,079,039
1893	686,852	615,957	4,317,021	147,483,828	54,431	3,766,445,347	89,061,287
1894	757,478	716,881	3,002,578	142,161,817	48,468	4,345,193,881	93,518,717
1895	775,046	358,455	1,341,533	219,564,320	47,596	3,574,510,454	97,253,458
1896	942,598	365,514	175,240	146,724,607	52,130	3,896,338,557	93,998,372
1897	928,567	1,072,914	246,178	197,816,134	63,266	4,918,905,733	113,347,175
1898	736,877	123,845	1,171,378	190,285,315	69,322	2,689,920,851	71,957,715
1899	930,042	513,499	530,420	204,177,293	71,898	3,980,250,769	74,089,899
1900	967,702	544,938	155,861	116,679,891	76,921	4,018,086,530	84,845,107
1901	983,059	583,208	371,911	117,199,710	70,076	3,975,005,840	89,806,453
1902	1,339,097	534,189	7,656,162	157,658,894	89,583	3,031,915,875	75,579,125
1903	1,494,132	516,570	358,505	169,656,284	87,025	4,216,108,106	108,574,905
1904	1,713,590	573,055	3,166,581	154,221,772	109,214	3,700,623,613	112,905,541
1905	1,923,174	594,680	181,199	106,483,515	100,301	3,680,932,998	102,706,599
1906	2,447,131	469,387	1,948,160	166,547,957	98,037	3,979,331,430	93,621,750
1907	3,449,517	565,252	176,917	209,603,180	99,061	4,391,839,975	86,368,490
1908	3,799,112	285,845	403,952	212,783,392	103,994	3,371,997,112	94,149,564
1909	4,129,454	517,388	8,383,966	222,900,422	91,451	4,189,421,018	114,916,520
1910	3,702,210	449,239	353,208	225,400,545	99,966	4,094,545,936	85,626,370
1911	4,405,827	629,842	218,984	208,774,795	117,727	3,937,978 265	102,653 942
Average:							
1851-1855	....	86,757	359,373	....	....	446,408,820	23,874,175
1856-1860	....	123,249	....	....	....	638,419,128	27,443,622
1861-1865	....	114,180	386,700	....	....	634,576,127	27,554,894
1866-1870	175,745	182,389	139,964	55,264,291	....	1,082,981,089	42,378,369
1871-1875	167,357	350,433	327,937	71,145,230	....	1,570,754,356	60,131,912
1876-1880	209,281	421,578	1,434,461	63,179,194	....	1,669,930,751	63,791,716
1881-1885	....	361,431	2,881,327	94,106,086	....	2,309,887,089	74,772,616
1886-1890	764,121	476,243	3,185,680	133,508,389	39,491	2,844,564,763	83,961,980
1891-1895	706,274	548,993	2,849,983	174,335,447	47,546	3,745,227,214	90,673,168
1896-1900	901,157	524,142	455,815	171,136,648	66,707	3,900,700,488	87,647,654
1901-1905	1,490,610	560,340	2,346,872	141,044,035	91,240	3,720,917,286	97,914,525
1906-1910	3,505,485	457,422	2,253,241	207,447,099	98,502	4,005,427,094	94,936,539

Imports of selected agricultural products, 1851–1911—Continued.

Year ending June 30—	Beeswax.	Onions.	Plums and prunes.	Raisins.	Currants.	Dates.	Figs.
	Pounds.	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1883	168,879						
1884	48,123		60,600,228	53,702,220			7,945,977
1885	91,754		57,631,820	38,319,787			7,770,178
1886	26 546		64,995,545	40,387,946			7,223,070
1887	10,843		92,032,625	40,673,288			8,724,583
1888	51,702		70,626,027	40,476,763			10,058,053
1889	75,951		46,154,825	35,091,139			10,649,049
1890	126,319		58,093,410	36,914,330			10,284,998
1891	379,135		34,281,322	39,572,655	33,128,140	18,239,057	9,201,565
1892	271,068		10,869,797	20,687,640	36,665,828	17,084,557	8,338,759
1893	248,000		26,414,112	27,543,563	33,166,546	16,211,906	10,503,928
1894	318,660		9,908,122	13,751,050	52,664,843	12,408,192	7,985,959
1895	288,001		14,352,057	15,921,278	16,450,706	15,186,789	11,855,890
1896	273,464		483,658	10,826,094	33,040,846	13,680,302	11,900,710
1897	174,017	560,138	710,028	12,650,598	29,265,761	11,847,279	8,940,762
1898	272,097	488,853	303,992	6,593,833	25,186,210	13,561,434	9,628,426
1899	452,016	771,960	600,360	4,933,201	30,849,253	12,943,305	7,284,058
1900	213,813	546,798	443,457	10,309,498	36,251,779	19,902,512	8,812,487
1901	213,773	774,042	745,974	3,860,836	16,049,198	20,013,681	9,933,871
1902	408,706	796,316	522,478	6,683,545	36,238,976	21,681,159	11,087,131
1903	488,576	925,599	633,819	6,715,675	33,878,209	43,814,917	16,482,142
1904	425,168	1,171,242	494,105	6,867,617	38,347,649	21,058,164	13,178,061
1905	373,569	856,366	671,604	4,041,689	31,742,919	19,257,250	13,364,107
1906	587,617	872,566	497,494	12,414,855	37,078,311	22,435,672	17,562,358
1907	917,088	1,126,114	323,377	3,967,151	38,392,779	31,270,899	24,346,173
1908	671,526	1,275,333	335,089	9,132,353	38,652,656	24,958,343	18,836,574
1909	764,937	574,530	296,123	5,794,320	32,482,111	21,869,218	15,235,513
1910	972,145	1,024,226		5,042,683	33,326,030	22,693,713	17,362,197
1911	902,904	1,514,967		2,479,220	33,439,565	29,504,592	23,459,728
Average:							
1886-1890	58,272		66,380,486	38,708,693			9,387,951
1891-1895	300,973		19,165,082	23,495,237	34,415,213	15,826,100	9,577,220
1896-1900	277,081		508,299	9,062,645	30,918,770	14,386,966	9,313,289
1901-1905	381,958	904,713	613,596	5,633,872	31,251,390	25,165,034	12,809,062
1906-1910	782,663	974,554		7,270,272	35,986,377	24,645,569	18,668,563

Year ending June 30—	Hides and skins, other than furs.			Macaroni, vermicelli, and all similar preparations.	Lemons.	Oranges.	Walnuts.
	Cattle.	Goat.	Other than cattle and goat.				
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1895		54,240,492	172,335,253				
1896		46,747,029	163,650,982				
1897		49,868,020	156,232,824				
1898	126,243,595	64,923,487	54,607,534				
1899	130,396,020	69,728,945	66,965,785				
1900	163,865,165	81,998,818	100,070,795		160,198,056	68,618,938	
1901	129,174,624	73,745,596	77,989,617		148,514,614	50,332,914	
1902	148,627,907	88,038,516	89,457,680		164,075,309	52,742,476	
1903	131,644,325	85,114,070	102,340,303	28,787,821	152,004,213	56,872,070	12,362,567
1904	85,370,168	86,338,547	103,024,752	40,224,202	171,923,221	35,893,260	23,670,761
1905	113,177,357	97,803,571	126,893,934	53,441,080	139,084,321	28,880,575	21,684,104
1906	156,155,300	111,079,391	158,045,419	77,926,029	138,717,252	31,134,341	24,917,028
1907	134,671,020	101,201,596	135,111,199	87,720,730	157,859,906	21,267,346	32,597,592
1908	98,353,249	63,640,758	120,770,918	97,233,708	178,490,003	18,397,429	28,887,110
1909	192,252,083	104,048,244	148,253,998	85,114,003	135,183,550	8,435,873	26,157,703
1910	318,003,538	115,844,758	174,770,732	113,772,801	160,214,785	4,676,118	33,641,466
1911	150,127,796	86,913,842	137,849,757	114,779,116	134,968,924	7,672,186	33,619,434
Average:							
1896-1900		62,653,260	108,305,584				
1901-1905	121,598,876	86,208,060	99,941,257		155,120,336	44,944,259	
1906-1910	179,887,038	99,162,949	147,390,453	92,353,454	154,093,099	16,782,221	29,240,180

Foreign trade of the United States in forest products, 1851–1911.

[Compiled from reports of Foreign Commerce and Navigation of the United States. All values are gold.]

Year ending June 30—	Exports.		Imports.	Excess of exports (+) or of imports (−).
	Domestic.	Foreign.		
1851	$4,188,635	$566,554	$1,332,522	+$3,422,667
1852	4,400,741	411,166	1,133,785	+ 3,678,122
1853	4,704,394	341,566	1,244,991	+ 3,800,969
1854	8,636,443	470,483	1,881,492	+ 7,225,434
1855	8,879,743	1,320,670	5,400,736	+ 4,799,677
1856	7,474,074	926,299	6,620,505	+ 1,779,868
1857	10,411,894	1,164,280	6,419,320	+ 5,156,854
1858	10,579,417	1,295,768	6,631,396	+ 5,243,789
1859	11,396,163	747,621	6,488,908	+ 5,654,876
1860	10,299,959	846,929	8,086,735	+ 3,060,153
1861	7,286,605	756,112	7,084,695	+ 958,022
1862	6,468,911	808,273	5,982,091	+ 1,295,093
1863	6,544,788	872,515	7,849,625	− 432,322
1864	6,608,236	616,086	10,401,691	− 3,177,369
1865	7,629,020	1,109,049	6,688,145	+ 2,049,924
1866	9,579,561	584,459	11,635,299	− 1,471,279
1867	11,175,119	599,918	12,975,903	− 1,200,866
1868	11,956,584	674,786	12,586,964	+ 44,406
1869	11,885,488	361,480	14,326,334	− 2,079,366
1870	11,984,445	1,181,708	17,555,708	− 4,389,555
1871	11,874,850	635,847	16,617,972	− 4,107,275
1872	16,494,184	1,004,495	19,402,210	− 1,903,531
1873	19,578,615	774,909	24,452,286	− 4,098,762
1874	21,143,701	1,116,763	21,468,824	+ 791,640
1875	16,680,377	1,019,887	17,295,187	+ 405,077
1876	15,636,980	883,254	16,023,785	+ 496,449
1877	18,312,446	532,547	15,386,709	+ 3,458,284
1878	17,180,147	705,941	16,344,201	+ 1,541,887
1879	16,023,005	557,434	18,745,076	− 2,164,637
1880	17,056,870	614,399	27,847,871	−10,176,602
1881	19,324,096	352,249	31,707,280	−12,030,935
1882	25,580,254	1,321,446	36,962,880	−10,061,180
1883	28,645,199	2,137,165	37,623,551	− 6,841,187
1884	26,222,959	1,450,032	35,931,961	− 8,258,979
1885	22,014,839	1,125,404	28,702,940	− 5,562,697
1886	21,061,708	1,052,083	32,042,431	− 9,928,640
1887	21,126,152	1,568,996	34,704,566	−12,009,418
1888	23,991,092	1,319,270	39,861,356	−14,550,994
1889	26,997,602	1,767,853	36,887,715	− 8,122,260
1890	29,473,084	1,337,677	40,010,518	− 9,199,757
1891	28,715,713	1,220,002	46,772,282	−16,836,567
1892	27,957,928	1,542,639	47,052,892	−17,552,325
1893	28,127,281	1,178,837	49,720,275	−20,414,157
1894	28,001,461	1,973,803	39,683,781	− 9,708,517
1895	28,576,680	1,277,705	43,302,134	−13,447,749
1896	33,718,790	2,563,550	45,696,324	− 9,413,984
1897	40,490,428	3,242,262	44,791,463	− 1,058,773
1898	38,439,418	2,582,082	45,751,938	− 4,730,438
1899	42,828,732	3,011,832	53,314,266	− 7,473,702
1900	52,676,575	3,981,002	60,633,078	− 3,975,501
1901	55,369,161	3,599,192	57,143,650	+ 1,824,703
1902	48,928,764	3,609,071	59,187,049	− 6,649,214
1903	58,734,016	2,865,325	71,478,022	− 9,878,681
1904	70,085,789	4,177,352	79,619,296	− 5,356,155
1905	63,199,348	3,790,097	92,680,555	−25,691,110
1906	76,975,431	4,809,261	96,462,364	−14,677,672
1907	92,948,705	5,500,331	122,420,776	−23,971,740
1908	90,362,073	4,570,397	97,733,092	− 2,800,622
1909	72,442,454	4,982,810	123,920,126	−46,494,862
1910	85,030,230	9,801,881	178,871,797	−84,039,686
1911	103,038,892	7,586,854	162,311,565	−51,685,819
Average:				
1851–1855	6,161,991	622,088	2,198,705	+ 4,585,374
1856–1860	10,032,301	996,179	6,849,373	+ 4,179,107
1861–1865	6,907,512	832,407	7,601,249	+ 138,670
1866–1870	11,316,239	680,470	13,816,042	− 1,819,333
1871–1875	17,154,345	910,380	19,847,296	− 1,782,571
1876–1880	16,841,890	658,715	18,869,528	− 1,368,923
1881–1885	24,357,469	1,277,259	34,185,722	− 8,550,994
1886–1890	24,529,928	1,409,176	36,701,317	−10,762,213
1891–1895	28,275,813	1,438,597	45,306,273	−15,591,863
1896–1900	41,630,789	3,076,146	50,037,414	− 5,330,479
1901–1905	59,263,416	3,608,207	72,021,714	− 9,150,091
1906–1910	83,551,779	5,932,936	123,881,631	−34,396,916

Exports of selected domestic forest products, 1851–1911

[Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are lacking, either there were no exports or they were not separately classified for publication.]

Year ending June 30—	Lumber.			Rosin.	Spirits of turpentine.	Timber.	
	Boards, deals, and planks.[1]	Shooks, other than box.	Staves.			Hewn.	Sawed.
	M feet.	*Number.*	*Number.*	*Barrels.*	*Gallons.*	*Cubic feet.*	*M feet.*
1851	100,604			387,220	363,828		
1852	100,695			449,194	358,658		
1853	78,599			454,715	634,371		
1854	197,154			601,280	1,669,523		
1855	144,718			731,060	2,339,138		
1856	126,330			524,799	1,844,560		
1857	309,165			641,517	1,522,177		
1858	217,861			574,573	2,457,235		
1859	197,099			798,083	2,682,230		
1860	170,922			770,652	4,072,023		
1861	132,332			536,207	2,941,855		
1862	129,243			65,441	43,507		
1863	135,901			17,025	58,565		
1864	132,298	1,019,340		2,418	32,548		
1865	172,644	1,043,797		11,232	51,863		
1866	120,013			250,452	349,325		
1867	131,666			334,104	1,513,225		
1868	131,873			443,501	3,068,629		
1869	134,370			585,989	3,184,955		
1870	140,863			583,316	3,246,697	7,115,975	
1871	154,830			511,959	2,453,554	7,115,007	
1872	176,872			692,728	4,495,441	12,594,738	
1873	236,557			845,162	5,114,653	14,154,244	
1874	228,481			929,342		25,209,048	
1875	213,974			937,527	5,599,624	13,553,714	
1876	252,407			824,256		21,786,414	
1877	321,530				6,796,927	20,640,259	
1878	313,143			1,042,183	7,633,568	18,361,915	
1879	275,102			1,112,816	7,575,556	13,255,241	
1880	285,194			1,040,345	7,091,200	16,365,346	
1881	320,602			1,023,710	6,595,528	22,961,618	
1882	407,455			1,156,012	8,136,493	24,491,354	
1883	499,406			1,347,256	9,867,344	19,913,220	
1884	414,920	1,275,450		1,545,211	11,300,729	10,615,065	201,257
1885	412,424	1,281,571		1,269,304	8,987,226	8,411,066	153,248
1886	435,608	1,098,347		1,131,560	8,217,678	5,077,612	193,344
1887	424,760	902,269		1,365,012	10,209,883	4,260,639	167,609
1888	436,718	668,972		1,492,314	10,585,942	5,813,175	187,780
1889	571,075	543,597		1,420,218	9,681,759	6,301,065	252,996
1890	612,814	534,190		1,601,377	11,248,920	8,732,761	270,984
1891	613,406	316,242		1,790,251	12,243,621	6,900,073	214,612
1892	592,596	412,308		1,950,214	13,176,470	6,736,446	235,550
1893	629,355	385,863		2,059,407	13,415,459	7,836,921	214,198
1894	574,920	383,706		1,987,128	12,618,407	4,082,709	237,830
1895	588,781	352,928		1,862,394	14,652,738	6,039,539	297,693
1896	694,799	643,099		2,172,991	17,431,566	5,616,476	332,934
1897	876,689	695,858		2,429,116	17,302,823	6,406,824	391,291
1898	790,659	544,079	54,142,759	2,206,203	18,351,140	5,489,714	338,575
1899	970,170	616,380	44,382,689	2,563,229	17,761,533	4,796,658	406,448
1900	1,046,758	773,019	49,011,533	2,369,118	18,090,582	4,416,741	473,542
1901	1,101,815	714,651	47,363,262	2,820,815	20,240,851	4,624,698	533,920
1902	942,814	788,241	46,998,512	2,535,962	19,177,788	5,388,439	412,750
1903	1,065,771	566,205	55,879,010	2,396,498	16,378,787	3,291,498	530,659
1904	1,426,784	533,182	47,420,095	2,585,108	17,202,808	3,788,740	558,690
1905	1,283,406	872,192	48,286,285	2,310,275	15,894,813	3,856,623	486,411
1906	1,343,607	1,066,253	57,586,378	2,438,556	15,981,253	3,517,046	552,548
1907	1,623,964	803,346	51,120,171	2,560,966	15,854,676	3,278,110	600,865
1908	1,548,130	900,812	61,696,949	2,712,732	19,532,583	4,883,506	463,440
1909	1,357,822	977,376	52,583,016	2,170,177	17,502,028	2,950,528	383,309
1910	1,684,489	928,197	49,783,771	2,144,318	15,587,737	3,245,196	451,721
1911	2,031,608	1,019,411	65,725,595	2,189,607	14,817,751	2,673,887	499,547

[1] Including "Joists and scantling," prior to 1884.

Exports of selected domestic forest products, 1851–1911—Continued.

Year ending June 30—	Lumber.			Rosin.	Spirits of turpentine.	Timber.	
	Boards, deals, and planks.	Shooks, other than box.	Staves.			Hewn.	Sawed.
Average:	*M feet.*	*Number.*	*Number.*	*Barrels.*	*Gallons.*	*Cubic feet.*	*M feet.*
1851–1855	124,354			524,694	1,073,104		
1856–1860	204,275			661,925	2,515,645		
1861–1865	140,484			126,465	625,668		
1866–1870	131,757			439,472	2,272,566		
1871–1875	202,143			783,344		14,525,350	
1876–1880	289,475					18,081,835	
1881–1885	410,961			1,268,299	8,977,464	17,278,465	
1886–1890	496,195	749,475		1,402,096	9,988,836	6,037,050	214,543
1891–1895	599,812	370,209		1,929,879	13,221,339	6,319,138	239,977
1896–1900	875,815	654,487		2,348,131	17,787,529	5,345,283	388,558
1901–1905	1,164,118	694,894	49,189,433	2,529,732	17,779,009	4,190,000	504,486
1906–1910	1,511,602	935,197	54,554,057	2,405,350	16,891,655	3,574,877	490,377

Imports of selected forest products, 1851–1911.

[Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are lacking, either there were no imports or they were not separately classified for publication.]

Year ending June 30—	Camphor, crude.	India rubber.	Rubber gums, total.	Lumber.		Shellac.	Wood pulp.
				Boards, deals, planks, and other sawed.	Shingles.		
	Pounds.	*Pounds.*	*Pounds.*	*M feet.*	*M.*	*Pounds.*	*Tons.*
1851	176,226						
1852	189,316						
1853	109,908						
1854	233,496						
1855	193,909						
1856	341,972						
1857	389,568						
1858	706,999						
1859	612,263						
1860	49,047						
1861	44,734						
1862	298,097	2,125,561	2,458,821			131,974	
1863	221,280	5,104,650	5,128,026			615,036	
1864	517,570			333		789,510	
1865	177,756					531,081	
1866	718,953		[1] 36,855	108,439		1,103,777	
1867	432,075		[1] 42,262	413,375		784,365	
1868	2,005	8,438,019	8,438,019	255,843		548,227	
1869			7,813,134				
1870			9,624,098				
1871			11,031,939	725,994			
1872			11,803,437	714,731	102,904		
1873	1,117,930		14,536,978	818,302	108,448		
1874	780,737		14,191,320	562,395	109,245		
1875	947,191		12,035,909	393,786	82,110		
1876	322,972		10,589,297	333,996	38,279		
1877	1,022,565		13,821,109	316,271	34,190		
1878	1,117,290		12,512,203	327,298	47,532		
1879	982,580		14,878,584	355,304	48,710		
1880	2,445,471		16,826,099	515,343	59,402		
1881	2,010,165		20,015,176	575,320	87,135		
1882	2,076,192		22,712,862	612,364	99,264		589
1883	2,312,166		21,646,320	572,099	104,657		
1884	2,047,732		24,574,025	600,762	86,219	2,865,753	7,491
1885	2,223,038		24,208,148	555,582	69,511	3,468,891	13,523

[1] Gutta-percha only.

Imports of selected forest products, 1851–1911—Continued.

Year ending June 30—	Camphor, crude.	India rubber.	Rubber gums, total.	Lumber.		Shellac.	Wood pulp.
				Boards, deals, planks, and other sawed.	Shingles.		
	Pounds.	*Pounds.*	*Pounds.*	*M feet.*	*M.*	*Pounds.*	*Tons.*
1886	1,133,913	....	29,263,632	547,832	79,150	4,396,431	10,139
1887	2,857,222	....	28,649,446	559,236	89,169	4,722,538	23,410
1888	2,779,719	....	36,628,351	608,743	161,715	4,206,850	35,133
1889	1,961,018	....	32,339,503	648,174	214,546	5,509,873	40,917
1890	2,055,287	....	33,842,374	660,327	194,168	4,739,465	43,478
1891	1,716,167	33,712,089	34,672,924	757,244	260,652	6,253,380	43,316
1892	1,955,787	39,976,205	40,284,444	663,253	363,027	6,310,266	41,118
1893	1,733,425	41,547,680	42,130,058	742,597	459,044	5,604,732	63,565
1894	1,323,932	33,757,783	34,256,546	514,619	378,632	4,868,681	35,587
1895	1,500,739	39,741,607	41,068,401	600,798	51,513	6,401,060	28,440
1896	945,629	36,774,460	40,618,314	786,209	....	6,056,957	45,143
1897	1,469,601	35,574,449	36,692,114	883,781	....	7,151,459	41,770
1898	2,047,234	46,055,497	46,691,974	353,215	435,421	6,984,395	29,846
1899	1,807,889	51,063,066	58,055,887	423,928	471,594	9,830,111	33,319
1900	1,789,580	49,377,138	58,506,569	680,226	541,040	10,621,451	82,441
1901	2,175,784	55,275,529	64,927,176	490,820	555,853	9,608,745	46,757
1902	1,831,058	50,413,481	67,790,069	665,603	707,614	9,064,789	67,416
1903	2,472,440	55,010,571	69,311,678	720,937	724,131	11,590,725	116,881
1904	2,819,673	59,015,551	74,327,584	589,232	770,373	10,933,413	144,796
1905	1,904,002	67,234,256	87,004,384	710,538	758,725	10,700,817	167,504
1906	1,668,744	[1] 57,844,345	81,109,451	949,717	900,856	15,780,090	157,224
1907	3,138,070	[1] 76,963,838	106,747,589	934,195	881,003	17,785,960	213,110
1908	2,814,299	[1] 62,233,160	85,809,625	791,288	988,081	13,361,932	237,514
1909	1,990,499	[1] 88,359,895	114,598,768	846,024	1,058,363	19,185,137	274,217
1910	3,026,648	[1] 101,044,681	154,620,629	1,054,416	762,798	29,402,182	378,322
1911	3,726,319	72,046,260	145,743,880	872,374	642,582	15,494,940	491,873
Average:							*Tons.*
1851–1855	180,571	....	....	....	....	....	....
1856–1860	419,970	....	....	....	....	....	....
1861–1865	251,887	....	....	....	....	....	....
1866–1870	....	....	5,190,874	....	....	....	....
1871–1875	....	....	12,719,917	643,042	....	....	....
1876–1880	1,178,176	....	13,725,458	369,642	45,623	....	....
1881–1885	2,133,859	....	22,631,306	583,225	89,357	....	....
1886–1890	2,157,432	....	32,144,661	604,862	147,750	4,715,031	30,615
1891–1895	1,646,010	37,747,073	38,482,475	655,702	302,574	5,887,624	42,405
1896–1900	1,611,987	43,768,922	48,112,972	625,472	....	8,128,875	46,504
1901–1905	2,240,591	57,389,878	72,672,178	635,426	703,339	10,379,698	108,671
1906–1910	2,527,652	[1] 77,289,184	108,577,212	915,128	918,220	19,103,060	252,077

[1] Including "Guayule gum," crude.

Agricultural statistics from census for 1910—Total population, total land area, farm area, improved, woodland, and other unimproved area, and their percentages in 1910, by States.

[Quantities expressed in thousands; 000 omitted.]

State and Division.	Total population.	Total land area.	Land in farms.				Percentage of land area.		Percentage of farm-land area.		
			Total.	Improved.	Woodland.	Other unimproved.	In farms.	Improved.	Improved.	Woodland.	Other unimproved.
	Number.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Maine	742	19,133	6,297	2,361	2,776	1,161	32.9	12.3	37.5	44.1	18.4
New Hampshire	431	5,780	3,249	929	1,503	818	56.2	16.1	28.6	46.2	25.2
Vermont	356	5,839	4,664	1,634	1,567	1,463	79.9	28.0	35.0	33.6	31.4
Massachusetts	3,366	5,145	2,876	1,165	1,065	647	55.9	22.6	40.5	37.0	22.5
Rhode Island	543	683	443	178	186	79	64.9	26.1	40.2	42.0	17.8
Connecticut	1,115	3,085	2,186	988	758	440	70.9	32.0	45.2	34.7	20.1
New York	9,114	30,499	22,030	14,844	4,436	2,750	72.2	48.7	67.4	20.1	12.5
New Jersey	2,537	4,809	2,574	1,803	538	232	53.5	37.5	70.1	20.9	9.0
Pennsylvania	7,665	28,692	18,587	12,674	4,281	1,632	64.8	44.2	68.2	23.0	8.8
N. Atlantic	25,869	103,665	62,906	36,576	17,109	9,222	60.7	35.3	58.2	27.1	14.7
Delaware	202	1,258	1,039	714	252	73	82.6	56.7	68.7	24.3	7.0
Dist. of Columbia	331	38	6	5	1	0	15.8	13.4	84.7	11.3	4.0
Maryland	1,295	6,362	5,057	3,355	1,467	235	79.5	52.7	66.3	29.0	4.7
Virginia	2,062	25,768	19,496	9,870	8,415	1,211	75.7	38.3	50.6	43.2	6.2
West Virginia	1,221	15,374	10,026	5,522	3,969	536	65.2	35.9	55.1	39.6	5.3
North Carolina	2,206	31,194	22,439	8,813	12,452	1,174	71.9	28.3	39.3	55.5	5.2
South Carolina	1,515	19,517	13,512	6,094	6,339	1,075	69.2	31.2	45.1	46.9	8.0
Georgia	2,609	37,584	26,953	12,298	13,003	1,653	71.7	32.7	45.6	48.3	6.1
Florida	753	35,111	5,254	1,805	3,008	440	15.0	5.1	34.4	57.2	8.4
S. Atlantic	12,195	172,205	103,782	48,480	48,905	6,398	60.3	28.2	46.7	47.1	6.2
Ohio	4,767	26,074	24,106	19,228	3,285	1,592	92.5	73.7	79.8	13.6	6.6
Indiana	2,701	23,069	21,300	16,931	3,371	998	92.3	74.7	79.5	15.8	4.7
Illinois	5,639	35,868	32,523	28,048	3,148	1,327	90.7	78.2	86.2	9.7	4.1
Michigan	2,810	36,787	18,941	12,832	2,928	3,181	51.5	34.9	67.8	15.4	16.8
Wisconsin	2,334	35,364	21,060	11,908	5,378	3,775	59.6	33.7	56.5	25.6	17.9
N. C. E. Miss. R.	18,251	157,162	117,929	88,947	18,109	10,873	75.0	56.6	75.4	15.4	9.2
Minnesota	2,076	51,749	27,676	19,644	3,922	4,110	53.5	38.0	71.0	14.1	14.9
Iowa	2,225	35,575	33,931	29,491	2,314	2,125	95.4	82.9	86.9	6.8	6.3
Missouri	3,293	43,985	34,591	24,581	8,919	1,091	78.6	55.9	71.1	25.8	3.1
North Dakota	577	44,917	28,427	20,455	422	7,550	63.3	45.5	72.0	1.5	26.5
South Dakota	584	49,196	26,017	15,827	383	9,807	52.9	32.2	60.8	1.5	37.7
Nebraska	1,192	49,157	38,622	24,383	803	13,436	78.6	49.6	63.1	2.1	34.8
Kansas	1,691	52,335	43,385	29,904	1,206	12,275	82.9	57.1	68.9	2.8	28.3
N. C. W. Miss. R.	11,638	326,914	232,648	164,285	17,970	50,394	71.1	50.3	70.6	7.7	21.7
Kentucky	2,290	25,716	22,189	14,354	6,952	883	86.3	55.8	64.7	31.3	4.0
Tennessee	2,185	26,680	20,042	10,890	8,008	1,143	75.1	40.8	54.3	40.0	5.7
Alabama	2,138	32,819	20,732	9,694	9,445	1,594	63.2	29.5	46.8	45.6	7.6
Mississippi	1,797	29,672	18,558	9,008	7,884	1,666	62.5	30.4	48.5	42.5	9.0
Louisiana	1,656	29,062	10,439	5,276	4,317	847	35.9	18.2	50.5	41.4	8.1
Texas	3,897	167,935	112,435	27,361	27,658	57,416	67.0	16.3	24.3	24.6	51.1
Oklahoma	1,657	44,425	28,859	17,551	3,569	7,739	65.0	39.5	60.8	12.4	26.8
Arkansas	1,574	33,616	17,416	8,076	8,512	828	51.8	24.0	46.4	48.8	4.7
S. Central	17,194	389,925	250,671	102,211	76,343	72,116	64.3	26.2	40.8	30.4	28.8
Montana	376	93,569	13,546	3,640	596	9,309	14.5	3.9	26.9	4.4	68.7
Wyoming	146	62,460	8,543	1,256	252	7,035	13.7	2.0	14.7	2.9	82.4
Colorado	799	66,341	13,532	4,302	892	8,339	20.4	6.5	31.8	6.5	61.7
New Mexico	327	78,402	11,270	1,467	1,491	8,312	14.4	1.9	13.0	13.2	74.6
Arizona	204	72,838	1,247	350	100	796	1.7	.5	28.1	8.0	63.9
Utah	373	52,598	3,398	1,368	146	1,884	6.5	2.6	40.3	4.3	55.4
Nevada	82	70,285	2,715	752	48	1,914	3.9	1.1	27.7	1.7	70.6
Idaho	326	53,347	5,284	2,779	585	1,920	9.9	5.2	52.6	11.1	36.3
Washington	1,142	42,775	11,712	6,373	1,542	3,797	27.4	14.9	54.4	13.2	32.4
Oregon	673	61,188	11,685	4,275	2,238	5,172	19.1	7.0	36.6	19.1	44.3
California	2,378	99,617	27,931	11,390	4,542	12,000	28.0	11.4	40.8	16.2	43.0
Far Western	6,826	753,420	110,862	37,953	12,430	60,479	14.7	5.0	34.2	11.2	54.6
United States	91,972	1,903,290	878,798	478,452	190,866	209,481	46.2	25.2	54.5	21.7	23.8

Agricultural statistics from census for 1910.

[Farms classified by size.]

State and Division	Percentage of all farms in State.										Average acreage per farm.	Average acreage of improved land per farm.	Total number of farms.
	Under 3 acres.	3 to 9 acres.	10 to 19 acres.	20 to 49 acres.	50 to 99 acres.	100 to 174 acres.	175 to 259 acres.	260 to 499 acres.	500 to 999 acres.	1,000 acres and over.			
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Acres.*	*Acres.*	*Number.*
Maine	0.2	5.8	5.9	15.8	29.8	27.7	9.4	4.4	0.8	0.2	104.9	39.3	60,016
New Hampshire	.3	8.7	7.9	16.7	23.1	23.1	11.0	6.7	1.9	.6	120.1	34.3	27,053
Vermont	.2	7.9	5.9	10.6	18.1	29.0	15.9	10.2	1.9	.4	142.6	50.0	32,709
Massachusetts	2.3	13.0	13.4	24.1	21.6	15.4	5.8	3.2	.9	.3	77.9	31.5	36,917
Rhode Island	2.7	11.1	12.2	21.6	23.9	17.9	5.9	3.3	1.0	.5	83.8	33.7	5,292
Connecticut	.8	10.0	11.6	23.5	24.7	18.6	6.3	3.4	.7	.1	81.5	36.9	26,815
New York	.7	8.0	7.2	14.4	26.4	28.3	10.2	4.3	.5	.1	102.2	68.8	215,597
New Jersey	1.6	9.7	12.8	22.7	24.5	21.5	5.0	1.7	.3	.2	76.9	53.9	33,487
Pennsylvania	.4	8.7	8.5	18.1	30.0	25.3	6.4	2.2	.3	.1	84.8	57.8	219,295
N. Atlantic	0.7	8.5	8.3	17.1	26.9	25.5	8.4	3.8	0.6	0.2	95.7	55.7	657,181
Delaware	.3	6.2	7.7	18.3	27.5	26.3	9.2	4.0	.5	.1	95.9	65.8	10,836
Dist. of Col	......	......	......	......	......	......	......	......	......	......	27.9	23.7	217
Maryland	.3	10.2	10.4	17.6	20.3	23.4	10.3	6.2	1.0	.2	103.4	68.6	48,923
Virginia	.1	9.5	12.0	23.0	20.8	17.9	8.1	6.1	1.9	.5	105.9	53.6	184,018
West Virginia	.1	7.7	8.1	21.0	27.7	20.8	7.7	4.9	1.4	.5	103.7	57.1	96,685
North Carolina	(1)	5.9	11.1	29.8	24.5	17.3	6.2	3.8	1.1	.3	88.4	34.7	253,725
South Carolina	(1)	8.1	13.4	40.0	18.8	11.0	4.1	3.0	1.1	.5	76.6	34.6	176,434
Georgia	(1)	3.0	7.2	40.4	23.5	14.5	5.6	3.9	1.4	.5	92.6	42.3	291,027
Florida	.6	7.5	10.0	34.3	20.0	16.4	5.2	3.9	1.3	.7	105.0	36.1	50,016
S. Atlantic	0.1	6.5	10.2	31.9	22.7	16.3	6.3	4.3	1.3	0.4	93.4	43.6	1,111,881
Ohio	.3	7.1	6.9	18.5	32.4	25.3	6.7	2.5	.3	(1)	88.6	70.7	272,045
Indiana	.2	5.3	5.4	18.6	31.2	26.6	8.4	3.7	.4	.1	98.8	78.6	215,485
Illinois	.3	3.6	4.1	13.2	23.0	32.0	15.2	7.7	.7	.1	129.1	111.4	251,872
Michigan	.2	3.2	3.7	24.1	35.6	24.5	6.0	2.3	.3	.1	91.5	62.0	206,960
Wisconsin	.2	3.1	2.8	13.2	30.5	33.0	11.4	5.2	.5	.1	119.0	67.0	177,127
N.C.E. Miss. R.	0.2	4.7	4.7	17.6	30.3	28.1	9.5	4.3	0.5	0.1	105.0	79.2	1,123,489
Minnesota	.2	1.6	1.8	7.7	17.0	35.5	17.9	15.9	2.2	.2	177.3	125.8	156,137
Iowa	.2	3.4	2.8	7.2	17.8	36.9	18.6	11.9	1.1	.1	156.3	135.9	217,044
Missouri	.2	3.1	3.9	17.1	26.8	28.9	11.6	7.1	1.2	.2	124.8	88.7	277,244
North Dakota	.1	.1	.1	.6	1.6	30.9	7.2	39.1	17.0	3.2	382.3	275.1	74,360
South Dakota	.1	.4	.5	1.4	3.1	36.6	10.6	32.0	12.5	2.8	335.1	203.8	77,644
Nebraska	.1	1.8	1.5	3.5	9.7	33.9	16.0	20.4	10.1	3.0	297.8	188.0	129,678
Kansas	.1	2.4	2.0	6.0	14.7	32.5	15.0	19.5	5.9	1.9	244.0	168.2	177,841
N.C.W. Miss. R.	0.2	2.2	2.3	8.3	16.4	33.2	14.5	16.7	5.0	1.2	209.6	148.0	1,109,948
Kentucky	.1	8.4	12.9	22.6	25.4	19.3	6.7	3.6	.8	.2	85.6	55.4	259,185
Tennessee	.1	6.0	13.2	29.4	24.4	16.9	5.8	3.4	.8	.2	81.5	44.3	246,012
Alabama	(1)	5.2	10.7	40.6	21.1	13.5	4.5	3.1	.9	.3	78.9	36.9	262,901
Mississippi	.1	4.1	20.3	41.1	16.3	11.0	3.7	2.5	.8	.3	67.6	32.8	274,382
Louisiana	.3	5.5	18.5	38.5	16.8	11.3	3.9	3.1	1.3	.8	86.6	43.8	120,546
Texas	.1	2.2	4.8	23.6	26.9	22.6	7.6	6.5	3.1	2.7	269.1	65.5	417,770
Oklahoma	.1	1.0	2.7	16.6	20.5	39.5	8.5	9.3	1.4	.5	151.7	92.3	190,192
Arkansas	.1	2.9	13.9	34.9	21.1	18.3	5.2	2.8	.5	.2	81.1	37.6	214,678
South Central	0.1	4.3	11.4	30.3	22.3	19.2	5.9	4.4	1.3	0.8	126.2	51.5	1,985,666
Montana	1.0	.9	1.0	3.6	4.8	40.3	6.0	25.8	9.0	7.6	516.7	138.9	26,214
Wyoming	2.6	.8	.5	3.1	5.9	34.7	7.1	25.9	9.0	10.5	777.6	114.3	10,987
Colorado	1.2	4.8	4.9	8.4	9.5	35.4	6.5	20.5	5.3	3.4	293.1	93.2	46,170
New Mexico	2.8	9.0	7.5	7.9	5.1	43.1	3.8	16.9	2.3	1.6	315.9	41.1	35,676
Arizona	17.3	9.9	9.1	16.0	8.9	28.1	2.9	5.4	1.8	.8	135.1	38.0	9,227
Utah	1.4	8.5	11.7	25.6	19.2	16.9	6.3	6.0	2.5	1.8	156.7	63.1	21,676
Nevada	3.2	2.9	3.9	11.9	15.3	20.6	6.5	13.6	9.2	12.8	1,009.6	279.7	2,689
Idaho	.6	2.8	3.1	13.1	18.9	38.6	8.2	10.9	3.0	.8	171.5	90.2	30,807
Washington	1.0	8.2	9.6	18.2	12.6	24.7	5.5	10.9	6.2	3.1	208.4	113.4	56,192
Oregon	.5	5.8	6.9	15.1	14.9	26.4	8.1	12.4	6.0	3.8	256.8	93.9	45,502
California	1.4	10.6	13.5	23.4	12.1	13.6	5.3	8.9	5.8	5.3	316.7	129.1	88,197
Far Western	1.7	7.0	8.1	15.3	11.7	27.5	6.0	13.5	5.3	3.9	296.9	101.7	373,337
United States	0.3	5.0	7.9	22.2	22.6	23.8	8.4	7.0	2.0	0.8	138.1	75.2	6,361,502

(1) Less than one-tenth of 1 per cent.

Agricultural statistics from census for 1910.

[Quantities given in thousands; i. e., 000 omitted.]

State and Division.	Value of all farm property.		Value of land.		Value of buildings.		Value of implements and machinery.		Value of animals, poultry, and bees.	
	Total.	Per cent of 1900.	Total.	Per cent of 1900.	Total.	Per cent of 1900.	Total.	Per cent of 1900.	Total.	Per cent of 1900.
Maine	$199,272	162.8	$86,481	175.2	$73,138	155.1	$14,490	164.6	$25,162	147.1
N. H.	103,704	120.8	44,519	125.4	41,397	119.6	5,878	113.8	11,910	112.8
Vermont	145,400	134.1	58,385	127.4	54,203	145.5	10,169	134.9	22,643	126.9
Mass	226,474	124.0	105,533	121.4	88,636	124.7	11,564	131.0	20,741	131.3
R. I.	32,991	122.2	15,010	111.8	12,923	133.2	1,781	140.2	3,276	126.3
Connecticut	159,400	140.7	72,206	137.7	66,113	147.0	6,917	139.8	14,164	129.6
New York	1,451,481	135.7	707,748	128.4	476,998	141.6	83,645	149.3	183,091	145.8
New Jersey	254,833	134.5	124,143	133.0	92,991	134.3	13,109	140.5	24,589	139.6
Pa	1,253,275	119.2	630,430	109.6	410,639	127.2	70,726	138.9	141,480	138.1
N. Atlantic.	3,826,830	129.7	1,844,455	122.7	1,317,038	135.2	218,279	142.8	447,056	139.5
Delaware	63,179	155.2	34,938	147.0	18,218	170.8	3,206	149.1	6,817	165.8
Dist. of Col.	8,476	73.5	7,194	74.2	1,037	65.9	92	67.9	153	122.0
Maryland	286,167	139.8	163,452	135.8	78,286	142.8	11,860	137.7	32,570	156.2
Virginia	625,065	193.2	394,659	196.7	137,399	193.6	18,116	182.8	74,891	178.2
W. Va	314,739	154.4	207,076	154.2	57,315	168.4	7,011	139.1	43,336	141.8
N. C	537,716	230.0	343,165	241.7	113,460	215.3	18,442	203.3	62,650	208.1
S. C.	392,128	255.3	268,775	269.3	64,113	237.8	14,109	212.8	45,131	223.4
Georgia	580,546	254.2	370,353	267.4	108,851	242.7	20,948	213.7	80,394	228.4
Florida	143,183	265.5	93,738	304.1	24,408	244.6	4,446	226.5	20,591	184.4
S. Atlantic.	2,951,201	203.0	1,883,350	209.3	603,087	196.7	98,230	184.2	366,533	188.6
Ohio	1,902,695	158.7	1,285,895	157.4	368,258	167.8	51,210	140.9	197,332	156.7
Indiana	1,809,135	184.9	1,328,197	193.2	266,079	172.7	41,000	150.0	173,860	158.7
Illinois	3,905,321	194.8	3,090,411	204.1	432,381	171.9	73,724	163.9	308,805	159.4
Michigan	1,088,858	157.7	615,258	145.3	285,880	179.9	49,916	173.3	137,804	174.3
Wisconsin	1,413,043	174.1	911,938	171.9	289,694	186.2	52,957	181.1	158,454	164.5
N. C. E. of Miss. R.	10,119,052	178.0	7,231,699	182.0	1,642,292	174.8	268,807	161.3	976,255	161.5
Minnesota	1,476,412	187.2	1,019,102	182.2	243,339	220.8	52,329	173.9	161,641	181.5
Iowa	3,745,861	204.2	2,801,974	223.0	455,406	189.1	95,478	164.7	393,003	140.9
Missouri	2,052,917	198.7	1,445,982	207.9	270,222	182.0	50,874	177.9	285,839	178.0
N. Dak	974,814	381.9	730,380	421.3	92,277	362.9	43,908	312.4	108,250	255.1
S. Dak	1,166,097	391.9	902,607	477.1	102,474	331.3	33,787	276.5	127,229	195.2
Nebraska	2,079,819	278.1	1,614,539	331.8	198,808	218.3	44,250	177.4	222,222	152.9
Kansas	2,039,390	236.0	1,537,977	289.0	199,580	179.1	48,310	163.8	253,524	132.8
N. C. W. of Miss. R.	13,535,310	238.1	10,052,561	258.2	1,562,106	206.0	368,936	186.9	1,551,708	159.6
Kentucky	773,798	164.3	484,465	166.4	150,995	166.1	20,852	136.3	117,487	159.3
Tennessee	612,521	179.5	371,416	183.9	109,107	172.8	21,292	139.8	110,706	182.0
Alabama	370,138	206.3	216,944	216.6	71,309	207.0	16,290	187.8	65,595	181.7
Mississippi	426,315	208.8	254,002	221.1	80,160	215.8	16,905	176.9	75,247	176.4
Louisiana	301,221	151.7	187,803	174.3	49,741	148.9	18,977	66.5	44,699	154.8
Texas	2,218,645	230.5	1,633,207	276.1	210,001	209.5	56,790	188.5	318,647	132.5
Oklahoma	918,199	330.9	649,067	434.5	89,611	418.6	27,089	257.7	152,433	158.4
Arkansas	400,089	220.5	246,022	234.1	63,145	210.0	16,864	192.7	74,058	197.6
S. Central	6,020,926	213.8	4,042,926	243.3	824,069	200.6	195,059	154.0	958,872	155.5
Montana	347,829	295.1	226,771	430.6	24,855	265.4	10,540	287.0	85,663	164.2
Wyoming	167,189	247.8	88,908	379.4	9,007	255.0	3,668	268.5	65,606	167.6
Colorado	491,472	305.2	362,822	401.6	45,697	285.6	12,792	269.5	70,161	140.5
New Mexico	159,448	296.6	98,807	570.4	13,024	365.3	4,122	358.0	43,495	137.1
Arizona	75,124	250.5	42,350	371.0	4,936	217.8	1,788	233.6	26,051	167.6
Utah	150,795	200.6	99,482	247.9	18,063	169.6	4,468	152.9	28,782	134.0
Nevada	60,399	210.6	35,277	265.7	4,333	185.2	1,576	177.4	19,214	157.9
Idaho	305,317	453.9	219,953	619.8	25,113	367.6	10,476	317.9	49,775	229.8
Washington	637,543	442.6	517,422	521.0	54,546	334.6	16,710	266.4	48,865	220.5
Oregon	528,244	305.8	411,696	363.9	43,880	228.5	13,206	203.0	59,462	175.3
California	1,614,695	202.7	1,317,195	208.9	133,406	172.2	36,493	171.2	127,600	189.6
Far Western	4,538,055	264.7	3,420,683	303.5	376,860	225.0	115,839	219.0	624,674	170.1
U. S.	40,991,374	200.5	28,475,674	218.1	6,325,452	177.8	1,265,150	168.7	4,925,098	160.1

Agricultural statistics from census for 1910.

State and Division.	Percentage of value of all property represented in— Lands.	Buildings.	Implements and machinery.	Domestic animals, poultry, and bees.	Average value per farm of— All property.	Lands and buildings only.	Average value of land per acre— 1910	1900
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
Maine	43.4	36.7	7.3	12.6	3,320	2,660	13.73	7.83
New Hampshire	42.9	39.9	5.7	11.5	3,833	3,176	13.70	9.83
Vermont	40.2	37.3	7.0	15.6	4,445	3,442	12.52	9.70
Massachusetts	46.6	39.1	5.1	9.2	6,135	5,260	36.69	27.62
Rhode Island	45.5	39.2	5.4	9.9	6,234	5,278	33.86	29.46
Connecticut	45.3	41.5	4.3	8.9	5,944	5,158	33.03	22.68
New York	48.8	32.9	5.8	12.6	6,732	5,495	32.13	24.34
New Jersey	48.7	36.5	5.1	9.6	7,610	6,484	48.23	32.86
Pennsylvania	50.3	32.8	5.6	11.3	5,715	4,747	33.92	29.70
North Atlantic	48.2	34.4	5.7	11.7	5,823	4,811	29.32	22.98
Delaware	55.3	28.8	5.1	10.8	5,830	4,905	33.63	22.29
District of Columbia	84.9	12.2	1.1	1.8	39,062	37,932	1,186.53	1,142.68
Maryland	57.1	27.4	4.1	11.4	5,849	4,941	32.32	23.28
Virginia	63.1	22.0	2.9	12.0	3,397	2,891	20.24	10.08
West Virginia	65.8	18.2	2.2	13.8	3,255	2,735	20.65	12.60
North Carolina	63.8	21.1	3.4	11.7	2,119	1,800	15.29	6.24
South Carolina	68.5	16.4	3.6	11.5	2,223	1,887	19.89	7.14
Georgia	63.8	18.7	3.6	13.8	1,995	1,647	13.74	5.25
Florida	65.5	17.0	3.1	14.4	2,863	2,362	17.84	7.06
South Atlantic	63.8	20.5	3.3	12.4	2,654	2,236	18.15	8.63
Ohio	67.6	19.4	2.7	10.4	6,994	6,080	53.34	33.35
Indiana	73.4	14.7	2.3	9.6	8,396	7,399	62.36	31.81
Illinois	79.1	11.1	1.9	7.9	15,505	13,986	95.02	46.17
Michigan	56.5	26.3	4.6	12.7	5,261	4,354	32.48	24.12
Wisconsin	64.5	20.5	3.7	11.2	7,978	6,784	43.30	26.71
N. Central East of Mississippi River	71.5	16.2	2.7	9.6	9,007	7,899	61.32	34.15
Minnesota	69.0	16.5	3.5	10.9	9,456	8,085	36.82	21.31
Iowa	74.8	12.2	2.5	10.5	17,259	15,008	82.58	36.35
Missouri	70.4	13.2	2.5	13.9	7,405	6,190	41.80	20.46
North Dakota	74.9	9.5	4.5	11.1	13,109	11,063	25.69	11.15
South Dakota	77.4	8.8	2.9	10.9	15,018	12,945	34.69	9.92
Nebraska	77.6	9.6	2.1	10.7	16,038	13,983	41.80	16.27
Kansas	75.4	9.8	2.4	12.4	11,467	9,770	35.45	12.77
N. Central West of Mississippi River	74.3	11.5	2.7	11.5	12,195	10,464	43.21	19.37
Kentucky	62.6	19.5	2.7	15.2	2,986	2,452	21.83	13.24
Tennessee	60.6	17.8	3.5	18.1	2,490	1,953	18.53	9.93
Alabama	58.6	19.3	4.4	17.7	1,408	1,096	10.46	4.84
Mississippi	59.6	18.8	4.0	17.7	1,554	1,218	13.69	6.30
Louisiana	62.3	16.5	6.3	14.8	2,499	1,971	17.99	9.74
Texas	73.6	9.5	2.6	14.4	5,311	4,412	14.53	4.70
Oklahoma	70.7	9.8	3.0	16.6	4,828	3,884	22.49	6.50
Arkansas	61.5	15.8	4.2	18.5	1,864	1,440	14.13	6.32
South Central	67.2	13.7	3.2	15.9	3,032	2,451	16.13	6.45
Montana	65.2	7.1	3.0	24.6	13,269	9,599	16.74	4.45
Wyoming	53.2	5.4	2.2	39.2	15,217	8,912	10.41	2.88
Colorado	73.8	9.3	2.6	14.3	10,645	8,848	26.81	9.54
New Mexico	62.0	8.2	2.6	27.3	4,469	3,135	8.77	3.38
Arizona	56.4	6.6	2.4	34.7	8,142	5,125	33.97	5.90
Utah	66.0	12.0	3.0	19.1	6,957	5,423	29.28	9.75
Nevada	58.4	7.2	2.6	31.8	22,462	14,730	12.99	5.17
Idaho	72.0	8.2	3.4	16.3	9,911	7,955	41.63	11.07
Washington	81.2	8.6	2.6	7.7	11,346	10,179	44.18	11.68
Oregon	77.9	8.3	2.5	11.3	11,609	10,012	35.23	11.23
California	81.6	8.3	2.3	7.9	18,308	16,447	47.16	21.87
Far Western	75.4	8.3	2.5	13.8	12,155	10,172	30.86	12.01
United States	69.5	15.4	3.1	12.0	6,444	5,471	14.96	15.57

Agricultural statistics from census for 1910.

FARM EXPENSES.

State and Division.	Labor.				Feed.			Fertilizer.		
	Farms reporting.		Cash expended. (000 omitted.)	Rent and board furnished. (000 omitted.)	Farms reporting.		Amount expended. (000 omitted.)	Farms reporting.		Amount expended. (000 omitted.)
	Number.	Per cent of all farms.			Number.	Per cent of all farms.		Number.	Per cent of all farms.	
Maine	37,199	62.0	$4,486	$1,147	46,643	77.7	$7,268	39,947	66.6	$4,069
New Hampshire	17,385	64.3	2,690	684	21,983	81.3	4,615	15,351	56.7	513
Vermont	21,810	66.7	3,580	1,168	26,332	80.5	4,759	19,033	58.2	571
Massachusetts	26,758	72.5	9,906	2,196	30,500	82.6	10,878	21,689	58.8	1,966
Rhode Island	3,521	66.5	1,429	332	4,358	82.4	1,678	3,318	62.7	335
Connecticut	17,955	67.0	5,512	1,369	21,569	80.4	5,416	15,584	58.1	1,954
New York	145,095	67.3	32,001	9,311	151,962	70.5	29,546	113,883	52.8	7,142
New Jersey	23,448	70.0	8,633	2,464	23,014	68.7	5,947	23,685	70.7	4,278
Pennsylvania	139,507	63.6	19,279	6,333	141,633	64.6	19,203	129,769	59.2	6,802
N. Atlantic	432,678	65.8	87,516	25,004	467,994	71.2	89,310	382,259	58.2	27,630
Delaware	6,841	63.1	1,257	355	3,461	31.9	338	9,023	83.3	865
District of Columbia	146	67.3	213	26	183	84.3	130	77	35.5	17
Maryland	31,982	65.4	6,743	2,059	23,198	47.4	2,445	37,154	75.9	3,388
Virginia	84,636	46.0	10,823	2,531	62,267	33.8	3,505	111,277	60.5	6,932
West Virginia	43,871	45.4	3,204	832	37,301	38.6	1,938	23,967	24.8	529
North Carolina	97,461	38.4	7,644	1,577	76,837	30.3	3,151	181,718	71.6	12,263
South Carolina	69,491	39.4	9,351	1,419	40,130	22.7	1,831	140,303	79.5	15,162
Georgia	113,782	39.1	11,186	2,032	75,975	26.1	4,097	236,271	81.2	16,860
Florida	21,160	42.3	4,992	362	16,628	33.2	1,820	29,826	59.6	3,610
S. Atlantic	469,370	42.2	55,413	11,193	335,980	30.2	19,255	769,616	69.2	59,626
Ohio	145,515	53.5	20,427	5,204	95,050	34.9	8,446	118,888	43.7	4,180
Indiana	103,947	48.2	14,013	3,669	74,889	34.8	6,894	55,431	25.7	2,190
Illinois	139,941	55.6	27,989	8,319	94,143	37.4	13,916	11,207	4.4	616
Michigan	111,842	54.0	15,074	3,989	75,882	36.7	5,683	31,327	15.1	945
Wisconsin	91,119	51.4	14,088	5,108	73,512	41.5	5,673	2,995	1.7	128
N. C. E. Miss. R.	592,364	52.7	91,591	26,289	413,476	36.8	40,612	219,848	19.6	8,059
Minnesota	94,934	60.8	16,674	5,656	58,551	37.5	5,042	1,436	.9	75
Iowa	108,890	50.2	18,586	6,195	81,302	37.5	18,582	1,776	.8	110
Missouri	120,714	43.5	14,971	3,674	110,416	39.8	17,148	18,434	6.6	671
North Dakota	45,775	61.6	17,198	4,542	19,624	26.4	2,003	175	.2	10
South Dakota	41,180	53.0	9,908	2,924	21,763	28.0	3,049	185	.2	11
Nebraska	62,665	48.3	11,422	3,606	49,251	38.0	12,568	369	.3	31
Kansas	92,189	51.8	16,264	4,303	76,921	43.3	17,815	1,415	.8	76
N. C. W. Miss. R.	566,347	51.0	105,023	30,900	417,828	37.6	76,207	23,790	2.1	984
Kentucky	91,642	35.4	10,007	2,237	65,693	25.3	4,015	56,783	21.9	1,351
Tennessee	88,670	36.0	7,037	1,411	70,212	28.5	3,571	53,498	21.7	1,216
Alabama	83,643	31.8	6,033	1,422	81,275	30.9	4,041	163,241	62.1	7,631
Mississippi	65,628	23.9	5,585	1,577	73,758	26.9	3,981	78,677	28.7	2,703
Louisiana	31,732	26.3	15,299	1,405	28,323	23.5	3,784	22,111	18.3	2,005
Texas	160,538	38.4	22,653	3,131	112,866	27.0	10,800	15,931	3.8	595
Oklahoma	73,126	38.4	7,964	1,874	62,546	32.9	5,863	622	.3	29
Arkansas	70,638	32.9	6,304	1,350	73,098	34.1	4,276	22,113	10.3	597
S. Central	665,617	33.5	80,882	14,407	567,771	28.6	40,331	412,976	20.8	16,127
Montana	12,482	47.6	8,258	2,672	8,089	30.9	1,741	89	.3	12
Wyoming	5,450	49.6	4,556	1,618	4,469	40.7	1,509	33	.3	5
Colorado	22,179	48.0	8,771	2,048	19,545	42.3	4,593	560	1.2	61
New Mexico	13,124	36.8	2,986	660	13,470	37.8	1,527	827	2.3	25
Arizona	3,300	35.8	2,061	444	2,714	29.4	541	33	.4	6
Utah	11,805	54.5	2,864	306	6,086	28.1	727	571	2.6	20
Nevada	1,776	66.0	2,315	678	1,085	40.4	443	35	1.3	8
Idaho	15,715	51.0	5,573	1,128	10,639	34.5	2,123	237	.8	21
Washington	29,965	53.3	12,602	2,769	29,375	52.3	5,045	1,801	3.2	87
Oregon	24,229	53.2	9,110	1,992	21,012	46.2	3,198	2,887	6.3	69
California	55,887	63.4	42,206	7,770	49,372	56.0	12,677	7,470	8.5	2,144
Far Western	195,912	52.5	101,302	22,085	165,856	44.4	34,124	14,543	3.9	2,458
United States	2,922,288	45.9	521,727	129,878	2,368,905	37.2	299,839	1,823,032	28.7	114,884

Agricultural statistics from census for 1910—Continued.

MORTGAGE DEBT REPORTS.

[No mortgage reports were secured for farms operated by tenants and managers.]

State and Division.	Farms operated by owners.					Farms consisting of owned lands only.				Average value per farm mortgaged.	Average debt per farm.
	Number free from mortgage debt.		Number with mortgage debt.		Number with no mortgage report.	Number reporting debt and amount.	Value of land and buildings (000 omitted).	Amount of mortgage debt (000 omitted).	Per cent of value of land and buildings.		
	Number.	Per cent.	Number.	Per cent.							
Maine	41,309	73.4	14,948	26.6	197	13,894	$39,774	$11,739	29.5	$2,863	$845
N. Hampshire	18,119	74.4	6,234	25.6	140	5,666	15,457	4,774	30.9	2,728	842
Vermont	14,851	53.1	13,140	46.9	74	12,138	36,859	12,436	33.7	3,037	1,025
Massachusetts	18,768	59.1	13,014	40.9	293	12,030	49,742	16,371	32.9	4,135	1,361
Rhode Island	2,811	70.4	1,180	29.6	96	1,001	4,088	1,356	33.2	4,084	1,355
Connecticut	13,080	56.8	9,958	43.2	196	9,062	37,906	11,859	31.3	4,183	1,309
New York	93,118	56.3	72,311	43.7	1,245	62,555	284,659	97,310	34.2	4,551	1,556
New Jersey	11,983	50.4	11,793	49.6	357	10,666	55,507	19,477	35.1	5,204	1,826
Pennsylvania	112,156	68.9	50,699	31.1	1,374	44,999	176,168	61,539	34.9	3,915	1,368
N. Atlantic	326,195	62.8	193,277	37.2	3,972	172,011	700,160	236,861	33.8	4,070	1,377
Delaware	3,817	62.8	2,264	37.2	97	2,021	8,802	3,069	34.9	4,355	1,518
Dist. Columbia	93	81.6	21	18.4	4	20	233	56	24.0	11,670	2,805
Maryland	21,084	63.5	12,127	36.5	308	10,754	44,399	15,674	35.3	4,129	1,457
Virginia	111,474	84.0	21,182	16.0	1,008	17,410	62,377	15,440	24.8	3,583	887
West Virginia	66,093	87.4	9,525	12.6	360	7,878	21,549	5,593	26.0	2,735	710
North Carolina	117,028	81.5	26,642	18.5	1,650	19,252	42,952	9,958	23.2	2,231	517
South Carolina	47,535	76.0	15,020	24.0	1,795	11,189	39,594	10,109	25.5	3,539	903
Georgia	78,004	81.0	18,257	19.0	2,367	13,839	37,526	10,988	29.3	2,712	794
Florida	29,614	85.2	5,160	14.8	625	4,159	12,884	2,710	21.0	3,098	652
S. Atlantic	474,742	81.2	110,198	18.8	8,214	86,522	270,316	73,597	27.2	3,124	851
Ohio	135,616	71.1	54,997	28.9	1,491	42,785	220,750	63,788	28.9	5,160	1,491
Indiana	89,847	61.2	56,914	38.8	1,740	40,108	251,961	57,487	22.8	6,282	1,433
Illinois	86,713	60.8	55,792	39.2	2,602	36,938	454,857	115,800	25.5	12,314	3,135
Michigan	88,705	51.8	82,631	48.2	974	68,655	250,874	75,997	30.3	3,654	1,107
Wisconsin	72,941	48.6	77,129	51.4	952	69,398	427,522	146,815	34.3	6,160	2,116
N. C. E. of Miss. R.	473,822	59.1	327,463	40.9	7,759	257,884	1,605,964	459,887	28.6	6,227	1,783
Minnesota	65,038	53.7	56,145	46.3	921	41,775	295,016	77,866	26.4	7,062	1,864
Iowa	63,234	48.2	68,045	51.8	1,724	50,452	735,265	204,243	27.8	14,574	4,048
Missouri	102,514	53.7	88,486	46.3	1,285	64,028	389,476	112,565	28.9	6,083	1,758
North Dakota	30,651	49.1	31,727	50.9	834	19,187	213,643	47,842	22.4	11,135	2,493
South Dakota	35,101	61.8	21,691	38.2	1,192	11,313	154,749	32,771	21.2	13,679	2,897
Nebraska	47,435	60.6	30,839	39.4	976	19,778	286,309	62,373	21.8	14,476	3,154
Kansas	60,582	55.2	49,249	44.8	1,277	30,442	287,082	70,820	24.7	9,430	2,326
N. C. W. of Miss. R.	404,555	53.9	346,182	46.1	8,209	236,975	2,361,540	608,480	25.8	9,965	2,568
Kentucky	135,505	80.4	33,039	19.6	1,788	25,846	81,315	23,411	28.8	3,146	906
Tennessee	118,285	83.1	24,006	16.9	1,834	17,362	47,232	12,626	26.7	2,720	727
Alabama	74,504	73.1	27,457	26.9	1,968	19,230	32,311	10,351	32.0	1,680	538
Mississippi	60,543	67.1	29,693	32.9	1,830	22,844	42,266	13,381	31.7	1,850	586
Louisiana	42,011	81.0	9,834	19.0	1,144	7,520	28,772	8,950	31.1	3,826	1,190
Texas	128,082	66.7	64,008	33.3	3,773	48,024	297,881	76,089	25.5	6,203	1,584
Oklahoma	46,889	56.5	36,036	43.5	2,479	24,588	122,327	27,385	22.4	4,975	1,114
Arkansas	82,321	78.6	22,374	21.4	1,954	16,555	35,035	8,941	25.5	2,116	540
S. Central	688,140	73.6	246,447	26.4	16,770	181,969	687,139	181,134	26.4	3,776	995
Montana	18,014	78.9	4,820	21.1	531	3,990	44,615	10,741	24.1	11,182	2,692
Wyoming	7,815	80.3	1,923	19.7	41	1,531	16,675	4,208	25.2	10,892	2,749
Colorado	26,822	73.6	9,636	26.4	535	7,571	77,332	18,986	24.6	10,214	2,508
New Mexico	31,382	94.6	1,775	5.4	241	1,397	10,683	2,590	24.2	7,647	1,854
Arizona	7,038	87.1	1,043	12.9	122	813	8,695	2,253	25.9	10,696	2,772
Utah	15,131	77.1	4,492	22.9	139	3,526	21,320	4,564	21.4	6,046	1,294
Nevada	1,805	83.3	361	16.7	9	309	4,297	1,464	34.1	13,907	4,738
Idaho	17,933	66.6	9,010	33.4	226	7,594	64,376	14,557	22.6	8,477	1,917
Washington	30,979	65.9	16,026	34.1	500	12,715	113,395	25,645	22.6	8,918	2,017
Oregon	24,855	66.3	12,632	33.7	309	10,274	93,525	21,166	22.6	9,103	2,060
California	39,368	59.5	26,749	40.5	515	21,430	250,199	60,037	24.0	11,675	2,802
Far Western	221,142	71.4	88,467	28.6	3,168	71,150	705,112	166,211	23.6	9,910	2,336
United States	2,588,596	66.4	1,312,034	33.6	48,092	1,006,511	6,330,231	1,726,170	27.3	6,289	1,715

Agricultural statistics from census for 1910—Continued.

NATIVITY OF FARM OPERATORS.

State and Division.	Number of farms operated by—			Percentage of all farm operators which are—			Percentage of operators who own their farm among—			Percentage of operators who are tenants among—		
	Native white.	Foreign white.	Negro and other nonwhite.	Native white.	Foreign white.	Negro and other nonwhite.	Native white.	Foreign white.	Negro and other nonwhite.	Native white.	Foreign white.	Negro and other nonwhite.
Maine	55,014	4,973	29	91.7	8.3	(1)	94.2	93.1	86.2	4.2	5.5	10.3
N. Hampshire	24,347	2,691	15	90.0	9.9	0.1	90.9	86.9	80.0	6.6	9.8	13.3
Vermont	28,968	3,721	20	88.6	11.4	.1	85.6	87.6	85.0	12.4	10.8	10.0
Massachusetts	28,431	8,362	124	77.0	22.7	.3	87.4	85.0	87.9	7.6	9.5	8.9
Rhode Island	4,408	843	41	83.3	15.9	.8	78.6	70.2	70.7	16.9	23.6	29.3
Connecticut	19,841	6,861	113	74.0	25.6	.4	86.5	87.4	69.9	10.0	9.2	19.5
New York	187,629	27,029	939	87.0	12.5	.4	77.2	77.8	86.0	21.0	19.9	12.5
New Jersey	26,796	6,215	476	80.0	18.6	1.4	70.3	81.0	55.7	26.6	15.7	38.7
Pennsylvania	204,917	13,832	546	93.4	6.3	.2	74.5	80.6	62.5	23.7	17.5	31.9
N. Atlantic	580,351	74,527	2,303	88.3	11.3	0.4	79.4	82.0	73.2	18.5	15.2	22.9
Delaware	9,504	410	922	87.7	3.8	8.5	57.3	79.0	44.0	41.6	19.3	54.2
Dist. of Columbia	168	37	12	77.4	17.1	5.5	48.8	75.7	66.7	44.6	16.2	25.0
Maryland	40,669	1,882	6,372	83.1	3.8	13.0	69.0	80.9	62.0	29.0	15.1	36.6
Virginia	134,155	1,749	48,114	72.9	1.0	26.1	74.4	90.0	67.0	24.5	7.9	32.6
West Virginia	95,138	839	708	98.4	.9	.7	78.5	88.9	78.8	20.6	10.3	20.2
North Carolina	187,657	412	65,656	74.0	.2	25.9	65.8	89.1	32.7	33.6	8.0	67.2
South Carolina	79,424	212	96,798	45.0	.1	54.9	55.2	67.9	21.0	43.9	30.2	78.8
Georgia	168,083	385	122,559	57.8	.1	42.1	49.2	76.9	12.8	50.1	19.5	87.1
Florida	34,080	1,215	14,721	68.1	2.4	29.4	79.4	87.1	49.6	17.5	5.8	49.7
S. Atlantic	748,878	7,141	355,862	67.4	0.6	32.0	64.8	84.9	28.7	34.2	11.7	71.1
Ohio	252,645	17,450	1,950	92.9	6.4	.7	69.9	81.9	67.3	29.1	17.1	31.2
Indiana	204,951	9,729	805	95.1	4.5	.4	68.2	83.9	58.6	30.7	15.3	39.5
Illinois	217,053	33,394	1,425	86.2	13.3	.6	57.1	61.1	55.4	41.9	38.2	43.4
Michigan	147,790	58,224	946	71.4	28.1	.5	80.3	90.8	83.0	18.7	8.5	16.1
Wisconsin	107,180	69,356	591	60.5	39.2	.3	81.2	91.4	92.9	17.7	8.1	6.4
N. C. East of Miss. R.	929,619	188,153	5,717	82.8	16.7	0.5	69.5	84.6	68.4	29.5	14.7	30.3
Minnesota	74,710	81,134	293	47.9	52.0	.2	70.2	85.6	66.2	28.7	13.9	33.1
Iowa	167,856	48,987	201	77.3	22.6	.1	58.8	69.9	67.7	40.2	29.6	31.3
Missouri	259,111	14,467	3,666	93.5	5.2	1.3	68.6	86.8	57.5	30.7	12.7	41.4
North Dakota	35,750	37,867	743	48.1	50.9	1.0	81.3	88.2	97.8	17.8	11.4	1.9
South Dakota	49,360	25,476	2,808	63.6	32.8	3.6	70.9	79.4	97.4	28.4	20.2	2.3
Nebraska	93,509	35,707	462	72.1	27.5	.4	56.0	74.3	79.9	43.1	25.4	19.9
Kansas	150,346	25,804	1,691	84.5	14.5	1.0	59.3	80.8	64.9	39.9	18.8	33.8
N. C. West of Miss. R.	830,642	269,442	9,864	74.8	24.3	0.9	64.3	80.7	74.7	34.8	18.9	24.5
Kentucky	245,499	1,956	11,730	94.7	.8	4.5	66.3	85.2	50.5	33.3	13.4	49.1
Tennessee	206,821	883	38,308	84.1	.4	15.6	64.2	81.0	27.9	35.5	17.8	71.9
Alabama	151,214	1,244	110,443	57.5	.5	42.0	56.7	89.5	15.5	42.9	9.9	84.5
Mississippi	108,909	736	164,737	39.7	.3	60.0	61.2	56.0	15.2	38.2	42.7	84.7
Louisiana	63,236	2,431	54,879	52.5	2.0	45.5	64.5	59.6	19.5	34.1	38.8	80.3
Texas	318,988	28,864	69,918	76.4	6.9	16.7	49.5	57.9	30.4	49.8	41.6	69.5
Oklahoma	161,773	7,748	20,671	85.1	4.1	10.9	42.4	73.4	53.9	57.2	26.3	45.9
Arkansas	148,627	2,458	63,593	69.2	1.1	29.6	60.4	87.4	23.1	39.1	12.2	76.9
S. Central	1,405,067	46,320	534,279	70.8	2.3	26.9	57.3	64.6	21.8	42.2	34.9	78.1
Montana	18,165	6,853	1,196	69.3	26.1	4.6	88.0	90.7	97.6	9.7	8.0	2.2
Wyoming	9,019	1,903	65	82.1	17.3	.6	88.3	92.1	93.8	8.8	5.2	4.6
Colorado	37,198	8,398	574	80.6	18.2	1.2	80.1	80.1	81.2	18.0	18.7	18.6
New Mexico	32,088	1,440	2,148	89.9	4.0	6.0	93.6	85.5	98.7	5.4	13.3	1.1
Arizona	5,218	806	3,203	56.6	8.7	34.7	84.5	79.9	98.3	13.1	16.7	1.3
Utah	15,948	5,452	276	73.6	25.2	1.3	90.2	94.8	78.3	8.8	4.7	21.4
Nevada	1,661	867	161	61.8	32.2	6.0	79.8	80.5	94.4	11.6	15.3	5.0
Idaho	24,694	5,708	405	80.2	18.5	1.3	87.1	93.1	84.7	11.3	6.0	15.3
Washington	37,770	17,297	1,125	67.2	30.8	2.0	82.5	90.4	62.3	15.5	8.5	36.7
Oregon	35,819	9,056	627	78.7	19.9	1.4	81.6	89.5	76.2	16.4	9.2	22.5
California	58,926	26,193	3,078	66.8	29.7	3.5	77.7	76.0	30.5	17.8	21.2	67.5
Far Western	276,506	83,973	12,858	74.1	22.5	3.4	83.8	85.0	76.1	13.8	13.3	23.0
United States	4,771,063	669,556	920,883	75.0	10.5	14.5	66.3	81.4	26.2	32.7	17.6	73.6

[1] Less than one-tenth of 1 per cent.

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